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Waterways Experiment Station

Refinement of a Comprehensive Watershed Water Quality Model with Application to the Chesapeake Bay Watershed

by Anthony S. Donigian, Jr., Brian R. Bicknell, Radha V. Chinnaswamy, Aqua Terra Consultants

Patrick N. Deliman, WES

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Prepared for U.S. Environmental Protection Agency

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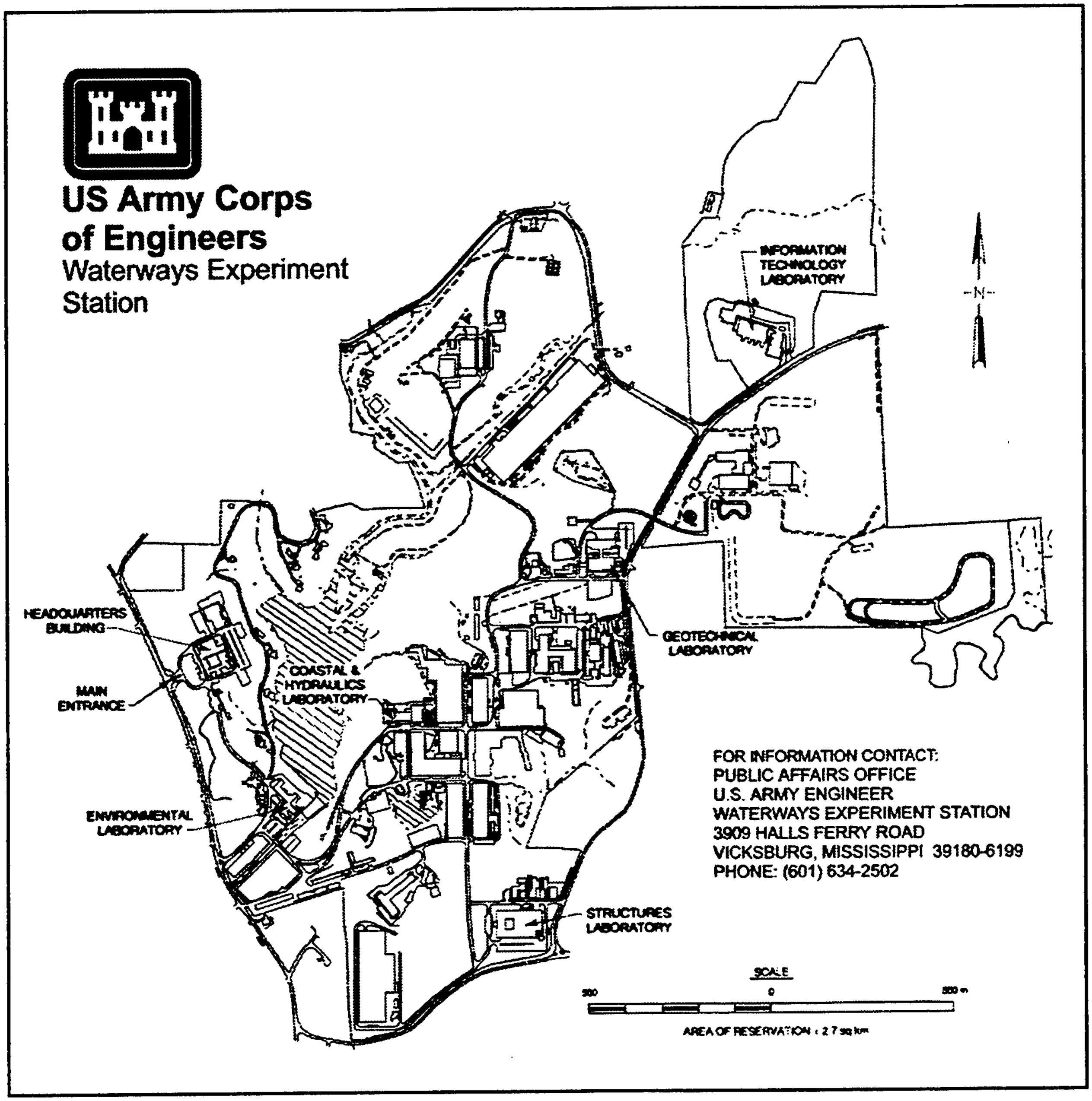

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Preface

The work herein was authorized under U.S. Army Engineer Waterways Experiment Station (WES) Contract No. DACW39-94-C-0052 with Aqua Terra Consultants, dated March 30, 1994, and was completed on May 31, 1995.

Dr. Patrick N. Deliman, Environmental Laboratory (EL), WES, was the Project Officer and co-author of this report. He was instrumental in facilitating the administration and execution of the contract work.

The Refinement of a Comprehensive Watershed Water Quality Model with Application to the Chesapeake Bay Watershed study, as documented in this report, was performed for the U.S. Environmental Protection Agency Chesapeake Bay Program Office (CBPO), Annapolis, MD. Mr. Lewis Linker, CBPO, was point of contact. The CBPO provided data for the test model segments within the Chesapeake Bay Watershed Model that were critical to the successful completion of this study. Mr. Linker and his staff at the CBPO are acknowledged for their assistance and cooperation.

Mr. Anthony S. Donigian, Jr., Aqua Terra, was the Principal Investigator and Project Manager, responsible for the overall technical direction of the work and preparation of the final report. Mr. Avinash Patwardhan, Aqua Terra, reviewed the available plant uptake functions and assisted Mr. Donigian in designing the new yield-based algorithms. Coding changes were designed by Mr. Brian R. Bicknell and implemented and tested by Mr. Thomas Jobes. Both were from Aqua Terra and performed data development for the extended simulation period of this study. Mr. Radha V. Chinnaswamy, also from Aqua Terra, performed model testing and calibration for all test subbasins under the direction of Messrs. Donigian and Mr. Bicknell. Messrs. Bicknell and Chinnaswamy were also authors of this report.

At the time of publication of this report, Director of WES was Dr. Robert W. Whalin, and EL Director was Dr. John Harrison. Dr. Richard E. Price was Chief, Environmental and Effects Division, EL. WES Commander was COL Robin R. Cababa, EN.

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> Donigian, A. S., Jr., Bicknell, B. R., Chinnaswamy, R. V., and Deliman, P. N. (1998). "Refinement of a comprehensive watershed water quality model with application to the Chesapeake Bay watershed," Technical Report EL-98-6, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Conversion Factors, Non-SI to SI Units of Measurement

Non-SI units of measurement used in this report can be converted to SI units as follows:

Multiply	By	To Obtain
acres	2.471	hectares
cubic feet	0.02831685	cubic meters
Fahrenheit degrees	5/9	Celsius degrees[1]
feet	0.3048	meters
inches	2.54	centimeters
pounds	0.4535924	kilograms
square miles	2.590	square kilometers

[1] To obtain Celsius (C) temperature from Fahrenheit (F) readings, use the following formula: C = (5/9) (F-32).

1 Introduction

Study Background

In 1987 the Chesapeake Bay Agreement was signed by the EPA Administrator and governors of the member states recommending a 40% reduction in nutrient loadings to the Chesapeake Bay to restore and maintain the water quality and living resources of the Bay. The Chesapeake Bay Watershed Model, based on the U.S. EPA Hydrologic Simulation Program-Fortran (HSPF) (Bicknell et al. 1993) was used to provide a framework for quantifying and evaluating the needed nutrient loading reductions to the Chesapeake Bay, and to allow the Chesapeake Bay Program Office (CBPO) to evaluate the impacts of land use changes and alternate nutrient and agricultural management practices. The Watershed Model provides total pollutant loadings from all land areas tributary to the Bay in order to drive a fully dynamic three-dimensional, hydrodynamic/water quality model of Chesapeake Bay.

Recent refinements and re-calibration of the Watershed Model produced a report (Donigian et al. 1994) describing the CBP Phase II Watershed Model application to the Bay drainage for calculating nutrient loadings to the Bay. That work included updating the model database for the 1984-87 period, incorporating detailed agricultural process simulation using the AGCHEM modules of HSPF, developing capabilities for instream sediment-nutrient interactions, and re-calibrating the improved model for the extended time period. The resulting Watershed Model produced a unique state-of-the-art watershed modeling capability that includes detailed soil process simulation for agricultural areas, linked to an instream water quality and nutrient model capable of representing comprehensive point and nonpoint pollutant loadings for the entire 68,000 square mile drainage area of the Chesapeake Bay.

Scope and Objectives

As a result of the CBP Phase II Watershed Model effort, additional improvements and refinements were identified and recommended to improve the overall utility of the Watershed Model as a planning tool for comprehensive watershed planning and assessment. The specific improvements recommended and tasks identified in this effort include the following developmental and application aspects:

Model Development and Refinement:

- Refine the AGCHEM simulation to better represent impacts of agricultural practices and nutrient management scenarios
- Test the AGCHEM refinements and develop automated output options to

provide summary model results for calibration and application

Model Testing and Application:

- Apply the refined AGCHEM to selected subbasins of the Chesapeake Bay drainage with updated land use data, finer model segmentation, and an extended database
- Re-calibrate the Watershed Model, with the refined AGCHEM, for the selected subbasins

The specific objectives of this research effort associated with the above identified tasks were envisioned as follows:

Model Development and Refinement

Task 1: Refine the AGCHEM plant uptake simulation

Previous reviews of the Watershed Model have recommended that the plant uptake algorithm and process should be further investigated to better represent the soil nutrient balances, and especially changes associated with management practices and nutrient reduction efforts. Subsequent research modeling efforts in both Maryland and Iowa have confirmed issues of plant uptake sensitivity to nutrient application rates and a need to re-calibrate uptake rates for nutrient reduction scenarios. In this task, the plant uptake function in AGCHEM was refined to include an additional option more indicative of crop requirements and yields, and more flexible for handling alternative cropping sequences, practices, and nutrient reduction alternatives.

Task 2: Test the Refined AGCHEM and develop output summaries

The refined AGCHEM module was tested on three selected model segments of the CBP Watershed Model for the agricultural land uses (i.e. conventional tillage, conservation tillage, hay land) that are represented by the AGCHEM procedures. Sensitivity analyses was performed both to thoroughly test the new coding and to develop parameter estimation guidance for the new algorithms. Automated procedures for outputting selected AGCHEM and Watershed Model results in a limited number of standard formats were developed to facilitate analysis of model output.

Model Testing and Application

Task 1: Apply the Refined AGCHEM with updated land use data, finer model segmentation, and an extended database

We selected three subbasins within the Chesapeake Bay drainage to fully test the refined AGCHEM module integrated within the Watershed Model framework. Figure 1 shows the CBP Phase III Watershed Model segmentation for the Above Fall Line (AFL) region, along with the locations of the three test subbasins. The three test subbasins included the Shenandoah River at Millville, WV; the Monocacy River at Jug Bridge, MD; and the West Branch Susquehanna River at Lewisburg, PA. The

AFL Model Segments

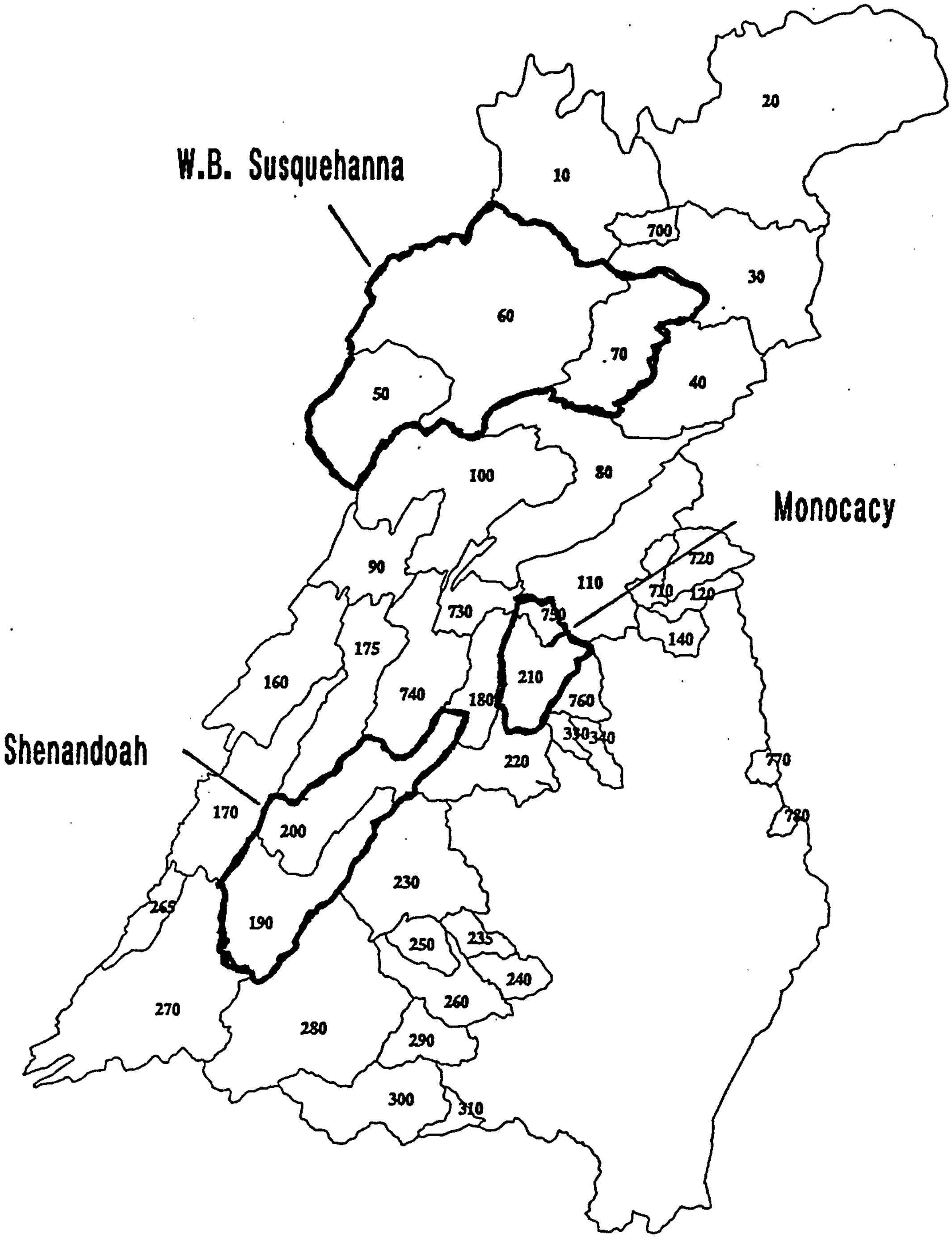


Figure 1. Chesapeake Bay Watershed Model and testing segments

original Phase II model segmentation was reviewed in coordination with CBPO and revised as needed in order to provide finer spatial detail in regions of special interest. The revised segmentation required development of new hydraulic functions (i.e. FTABLEs in HSPF) to represent the hydraulic properties of the additional river reaches, modifications to the current HSPF input sequences, and investigation of additional rainfall segmentation for the new segments.

In addition the following changes were performed to take advantage of more recent data and/or additional model capabilities implemented within the most recent version of HSPF (i.e. Version no. 11) planned for release in 1995:

a. Update land use data using the 1990 EPA-EMAP database
b. Extend database and simulation through 1991
c. Implement and utilize enhanced capabilities for AGCHEM chemical applications (i.e. SPECIAL ACTIONS in HSPF)
d. Implement direct atmospheric deposition of nutrients utilizing the enhanced capabilities of HSPF Version No. 11
e. Activate existing benthal process simulation capabilities within the instream module to improve the oxygen and nutrient modeling results

Updating land use information in the Watershed Model is a relatively straight-forward task as long as the land use categories are identical to the model categories and the updated information is adapted to the model segment boundaries. EPA provided the needed land use data for the three selected subbasins, and AQUA TERRA updated the input sequences to reflect the new data.

Updating of the land use information, based on the EPA-EMAP data, and extending the simulation period and associated databases through 1991, were performed by the EPA CBPO staff with general review, guidance, and assistance by AQUA TERRA. The final Phase III land use data (Neumiller et al. 1994) for the test subbasins was then used in the AGCHEM testing and Watershed Model re-calibration for the test subbasins for the extended simulation period through 1991. The timeseries datasets that were extended include the entire set of meteorologic data (rainfall, evaporation, wind, air temperature, solar radiation, cloud cover, and dewpoint), point source files, atmospheric deposition, diversions, and observed flow and water quality.

Task 2: Calibrate the Selected Watershed Model Subbasins with the Refined AGCHEM.

Following the AGCHEM refinements to the model, and upon incorporating the updated land use, the finer segmentation, the extended database, and the other changes noted above, the Watershed Model was re-calibrated to the three selected subbasins. The flow, sediment, and water quality results were compared to observed data, and a variety of analyses were performed to assess NPS loading rates from all the land use categories, and determine load contributions from all sources.

Conclusions and Recommendations

Below we summarize the key conclusions and recommendations derived from each of the three main topics of this effort: AGCHEM refinement and testing, Watershed Model Calibration, and Nutrient Reduction Scenarios.

AGCHEM Refinement and Testing

The addition of a yield-based plant uptake option in the AGCHEM module of HSPF, derived from the NLEAP uptake formulation, provides an improved algorithm for representing the plant uptake component of nutrient balances for agricultural croplands. The new algorithm allows for direct consideration of expected plant yield levels for both N and P, seasonal distribution of uptake rates and multiple cropping periods, N fixation by leguminous plants, and stress conditions related to available nutrient levels and moisture conditions. Nutrient deficit state conditions are assessed and enhanced uptake is allowed when additional nutrients become available.

Testing of the algorithm shows that it is sensitive to the available plant nutrients in the soil layers and to the target levels defined by the user corresponding to expected crop yields. The formulation is definitely less sensitive than the first-order option to nutrient application rates. Increasing application rates results in increased uptake but only up to the user-defined target levels; whereas, when application rates are decreased, the algorithm attempts to still meet the defined target levels, subject to the simulated stress conditions. Our testing has shown that decreased application rates will allow uptake levels to remain unchanged **only if** the plant available nutrients (from applications, atmospheric deposition, and mineralization) are sufficient to satisfy plant needs. This has important implications for agricultural BMPs that include nutrient reduction components.

Although all components and capabilities of the new yield-based plant uptake option in AGCHEM have been tested for proper operation, further testing under site and crop specific conditions is highly recommended. The 'composite crop' employed in the CBP Watershed Model, derived from parameters weighted by cropping distributions within each model segment, precluded detailed testing for individual crops and small-scale field conditions. Further testing at this level is recommended for evaluation of N fixation by leguminous crops, multiple cropping conditions, uptake timing and plant nutrient levels, and representation of stress conditions (i.e. nutrient and moisture). Small instrumented field sites, such as those in the Patuxent Basin (R. Summers, personal communication, 1994), the Nomini Creek/Owl Run sites in Virginia, the Conestoga basin in PA, and U.S.D.A. sites in Walnut Creek, IA should be considered for future testing and evaluation of the new yield-based algorithm.

Watershed Model Calibration

The refined Watershed Model resulting from this effort for the three test segments differs from the earlier Phase II Watershed Model in the following ways:

a. Land use was updated by CBPO to 1990 conditions (Neumiller at al. 1994).

b. Selected model segments were re-defined for finer spatial detail.
c. Precipitation and meteorologic data was reviewed and extended through 1991.
d. Point sources, diversion, and atmospheric deposition files were extended through 1991.
e. The yield-based plant uptake function was used in AGCHEM.
f. Enhanced SPECIAL ACTIONS capabilities were used to reduce the length of the model input and improve representation of chemical application practices.
g. Atmospheric deposition was included as timeseries directly input to chemical storages for the AGCHEM segments, taking advantage of additional HSPF Version No. 1 capabilities.
h. As part of the water quality calibration, benthic oxygen demand and benthic algae processes were activated within HSPF in order to improve the low DO and inorganic nutrient simulation.

In this study, the nonpoint loading assessment involved two primary components. The first involved the evaluation and analysis of the AGCHEM results using the new yield-based plant uptake function. Uptake targets, nutrient application rates, and simulated plant uptake amounts for both N and P were reviewed and evaluated to ensure consistency and reasonability of the results. The second component involved a review and relative comparison of the nonpoint loading rates for all the land uses, and an assessment of the relative load contributions from all sources. The key outcome of the loading rate comparison was the identification of the relatively high loading rates of $N0_3$ from the forest segment. Therefore, we adjusted the forest segment parameters, primarily decreasing the subsurface $N0_3$ concentrations, to reduce the model generated forest loads to the general range of 1.0 to 2.0 lb/ac/yr, reported in the literature.

Based on the results for all three model segments, the following conclusions and recommendations are provided:

a. The overall results show a significant improvement from the Phase II effort with improved seasonal variation and tracking of the observed values. However, problems still remain for selected constituents, and further 'fine tuning' of the calibration is recommended along with more detailed investigations into the algal simulation.

b. The addition of a benthal oxygen demand significantly improved the DO simulation during low flow periods that were typically over estimated in the Phase II results. This was an early indicator of the potential importance of the benthal processes on the overall water quality simulation.

c. The NO_3 simulations for the Shenandoah and West Branch Susquehanna segments show good agreement with the observed data. The seasonal variation is well represented for most years, but occasional peaks are well above the observed data. This is typical of most of the simulation results, and may be due to the relatively large model segments and long stream reaches used in the Watershed Model.

d. Both the NH_3 and PO_4 simulations are generally higher than the observed data points, but mostly in the overall range of the observed data for the

Shenandoah and West Branch Susquehanna. Both of these constituents are highly sensitive to the algal simulation (phytoplankton and benthic algae), for which no data was available for any of the test model segments. Additional instream algal data is probably the greatest data need at this time to help assess the validity of the phytoplankton (and benthic algae) simulation and its impact on the inorganic nutrient simulations.

It should be noted that for the Shenandoah, the greatest fraction of the total loads for both NH_3 and PO_4 are derived from point sources. Thus, although the concentration peaks are likely due to nonpoint sources, the point sources are major contributors to the total load.

e. The Total N results for the Shenandoah and West Branch Susquehanna segments are quite good and track the observed data with reasonable accuracy, while the Total P results are somewhat high.

f. The organic components follow this pattern i.e. the Organic N is similar to the observed while the Organic P is somewhat high, leading to the differences shown to the totals. In our simulations, 30% to 40% of the organics is derived from the animal waste model segment. Also, the organic loads from the non-AGCHEM segments are derived from the BOD simulation with the conversion to organic N and P based on algal stoichiometry as derived in Phase II. It is clear that the BOD-organics conversion factors could be adjusted to improve the organic P simulation without greatly deteriorating the organic N simulation. However, both the animal waste loading representation and the algal N/P ratios should be further investigated in a joint effort to improve the organic simulation.

g. Except for the inorganic nutrients, the Monocacy results are generally consistent with the level of agreement shown in the other test segments. Flow, sediment, water temperature, DO, BOD, TOC, Chl a, and benthic algae are all consistent with the other results, and show generally good agreement when observed data is available.

h. For the Monocacy, concentrations peaks for the inorganic nutrients are high in spite of the loads from the agricultural land uses being in the lower end of the expected range. Loadings from the other land uses are all reasonable, so the high peaks remain a mystery needing further analysis and calibration.

i. It should be noted that the Monocacy Segment 750 is the smallest of the Above Fall Line segments, and many of the watershed characteristics and parameters were based on the entire Phase II Segment 210 which included the new Segment 750 in the upper reaches of the watershed. Watersheds of this size, with low flows often less than 10 cfs, require more detailed spatial information in order to represent their behavior. Future efforts should review the land use, slopes, agricultural practices, and applications rates for this small watershed to assess the accuracy of the model input values.

Nutrient Reduction Scenarios

To demonstrate the use of the Watershed Model for evaluating the impacts of alternative nutrient reduction practices, selected scenarios were developed and simulated for the Shenandoah model segments. These alternatives were an outgrowth of the sensitivity runs performed with the AGCHEM module using the yield-based plant uptake algorithm. **These alternatives do not represent actual nor even recommended practices for the Shenandoah Basin; they are simply potential scenarios of model changes that are used to demonstrate and assess issues of concern in developing practices for evaluation.**

Two alternative scenarios were developed and compared to the Base Conditions which were represented by the calibrated conditions on the Shenandoah Basin. The alternatives were designed to represent a potential range of conditions that would likely be of interest. This demonstration of the simulation of alternative nutrient reduction scenarios has shown that the Watershed Model with the refined AGCHEM plant uptake routines provides a reasonable representation of nutrient balances at the watershed scale for evaluation of management options. Some of the conclusions and issues identified in this effort are as follows:

a. The form, amount, and timing of nutrient (fertilizer and manure) applications are critical to reasonable modeling of watershed nutrient balances and the potential impacts of nutrient reduction alternatives.

b. The Watershed Model with the refined AGCHEM plant uptake routines developed in this work provides a viable framework for investigating these issues -- form, amount, timing of applications -- and their impacts on resulting water quality.

c. Because of the critical importance of these application issues, further efforts should be directed to more accurately defining these parameters for both the current (Base) application scenario and potential nutrient reduction alternatives of interest to the CBPO and it member states.

d. Since nutrient application is a direct function of crop needs, the CBPO should consider upgrading the Watershed Model to simulate the major crops individually and remove the 'composite crop' representation and its associated limitations. Further investigation of specific practices (e.g. split applications, cover crops, manure practices) and expected crop yields for individual model segments should be pursued as part of this effort.

e. If manure management and utilization is to be a significant component of the CBP nutrient reduction efforts, mineralization and subsequent availability of organic N from animal waste should be further investigated and the ability of the AGCHEM module to represent this component should be improved. Current efforts are underway to include multiple organic N compartments within AGCHEM to better model dissolved organic N (DON) from forested areas; these refinements may provide an opportunity to also address the issues related to plant availability of manure N.

Format of this Report

Following this introduction, Chapter 2 describes the refinement of the AGCHEM plant uptake function, while Chapter 3 presents the results of testing and sensitivity analyses on the Shenandoah cropland model segments. The changes associated with using the new yield-based function and additional refinements in Phase III are discussed in Chapter 4, and calibration results are presented, for the three test model segments. In Chapter 5, alternative scenarios of nutrient reduction practices are discussed and the impacts on both segment and watershed nutrient loadings are presented for the Shenandoah, as a demonstration of the model capabilities for assessing nutrient management options. The Appendices include complete simulation results for each test subbasin along with the results of the alternative nutrient reduction scenarios.

2 Refinement of the AGCHEM Plant Uptake Function

Overview of AGCHEM and Plant Uptake Issue

Figure 2 shows the PERLND module of HSPF along with its various component submodules; the AGCHEM module (or subroutines) are shown within the dashed lines encompassing the MSTLAY, PEST, NITR, PHOS, and TRACER subroutines. Plant uptake of soil nutrients is performed within the NITR and PHOS modules, whose transformation diagrams are shown in Figure 3. Plant uptake, and all other biochemical transformations in Figure 3, are represented (in HSPF Version No. 10) as **first-order** rate processes with an Arhennius temperature correction adjustment based on simulated soil temperatures. The first-order plant uptake rates are defined by the user, can be specified separately for each soil zone (i.e. surface, upper, lower, groundwater) within HSPF, and can vary for each month to approximate the monthly pattern of crop growth and nutrient uptake. The rates are adjusted during calibration to mimic the expected annual nutrient uptake and the seasonal pattern for the specific crop and practice.

As part of the Phase II CBP Watershed Model application, potential nutrient management alternatives included reduced nutrient application rates for the agricultural cropland categories (Conventional Tillage, Conservation Tillage, Hay) in the Watershed Model. Since the AGCHEM modules of HSPF use first-order monthly uptake rates to represent time-varying plant nutrient uptake, the calculated uptake amounts are highly sensitive to, and a direct function of, the available nutrients in the soil profile and the specific nutrient application rates. This causes a problem when application rates are changed, such as under nutrient reduction alternatives, because the uptake amounts are not a function of expected crop yields and associated nutrient uptake; thus, even though sufficient nutrients may be available to satisfy crop needs under the reduced application rates, the calculated uptake may be less than the crop needs because of the first-order formulation.

Review of Available Plant Uptake Functions

As part of a previous effort, we reviewed the problem and issues related to the plant uptake algorithms in the AGCHEM modules (NITR, PHOS) of HSPF, along with the primary alternative algorithms used in a number of current agricultural nutrient models (Donigian and Patwardhan 1994). Based on that review effort and the compatibility of alternative functions with the AGCHEM and HSPF soil profile

PERLND Structure Chart

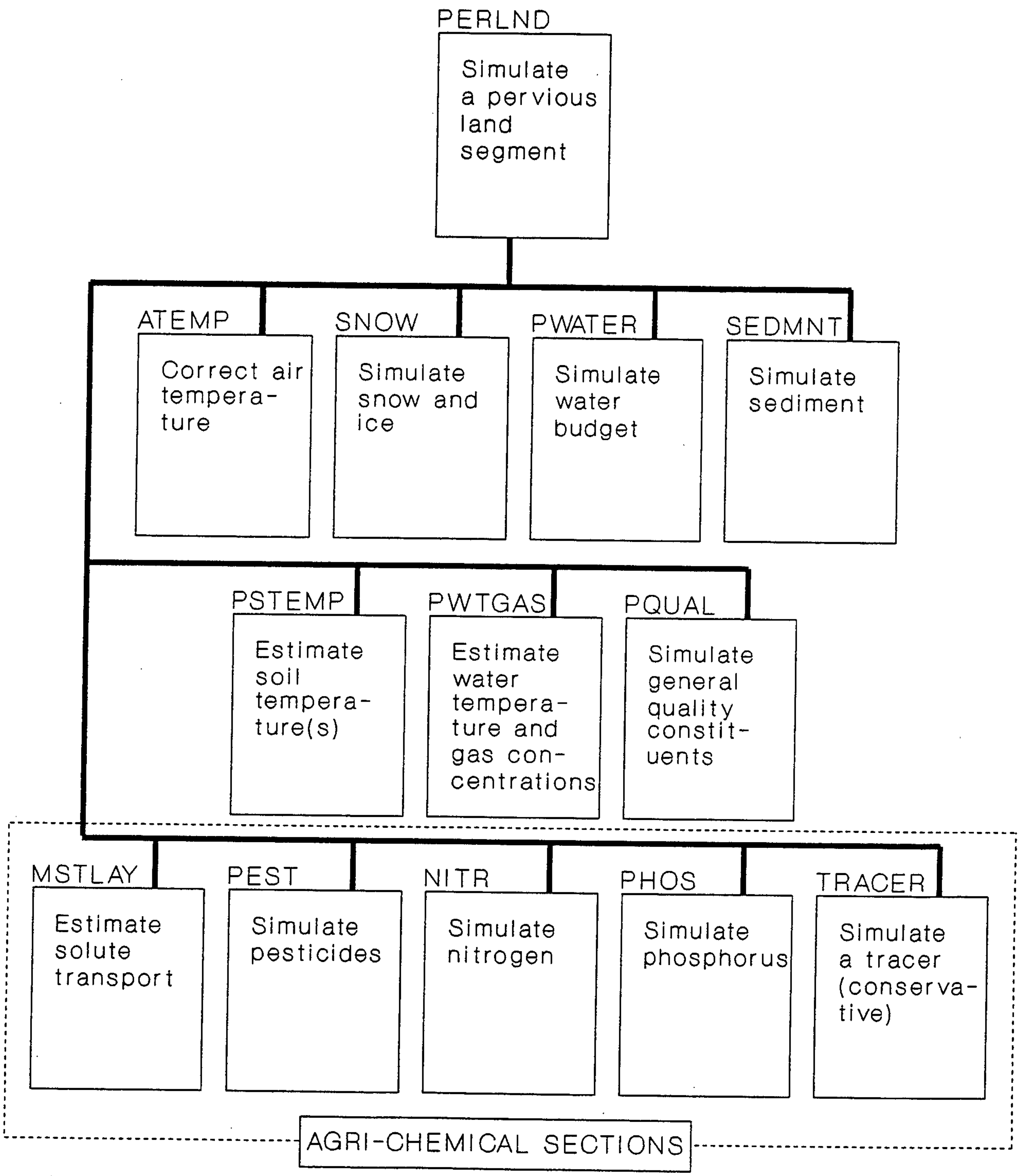
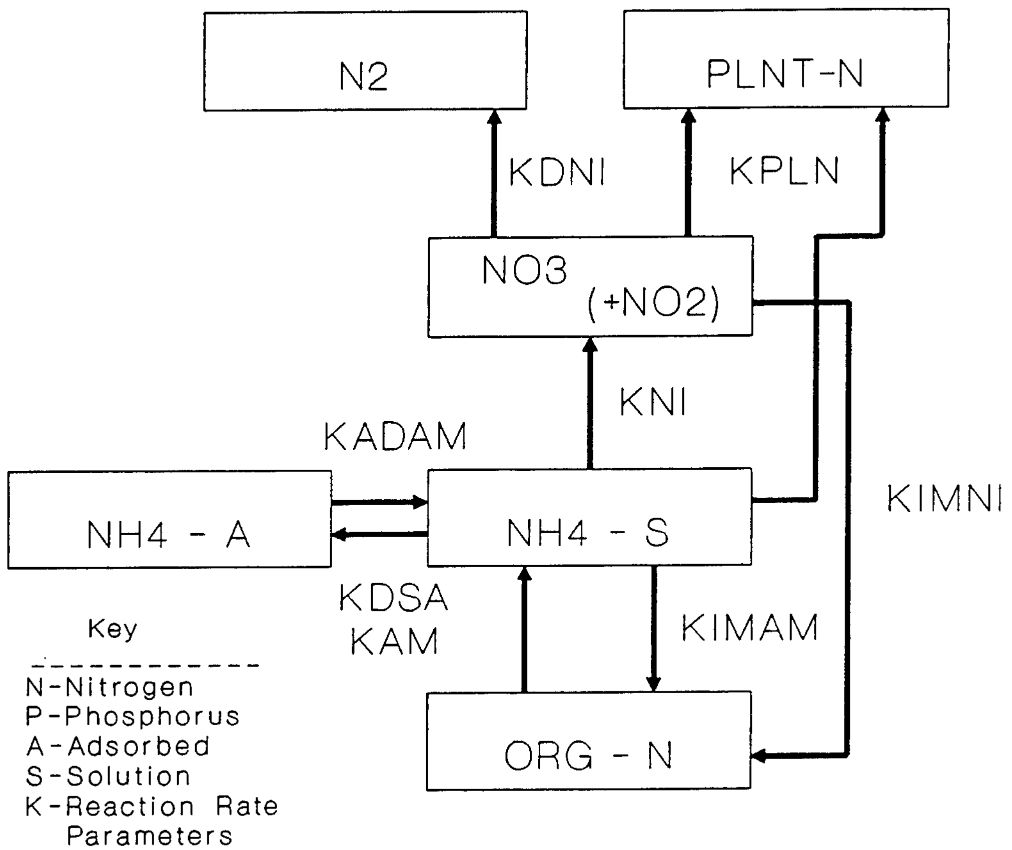
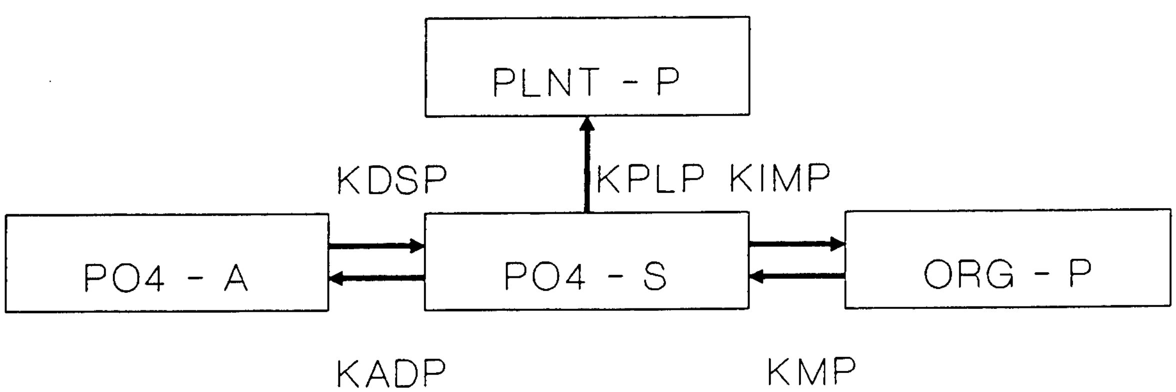


Figure 2. PERLND structure chart

Nutrient Transformations Simulated by the AGCHEM Module



A. Nitrogen transformations in NITR module



B. Phosphorus transformations in PHOS module

Figure 3. Nitrogen and phosphorus transformations in AGCHEM

representation, we selected the conceptual approach of the plant uptake formulation in the NLEAP model (Shaffer, Halvorson, and Pierce 1991) for incorporation into AGCHEM.

This selection was based on review and evaluation of the plant uptake algorithms for the following seven agricultural models:

MODEL	**REFERENCE**
CREAMS	Knisel 1980
OPUS	Smith 1992
NLEAP	Shaffer, Halvorson, and Pierce 1991
DRAINMOD-N (same as NLEAP)	Breve 1994, Skaggs 1978
GLEAMS (same as CREAMS)	Leonard, Knisel, and Still 1986
EPIC	Sharpley and Williams 1990
ADAPT (it is same as GLEAMS)	Ward, Alexander, Fausey, and Dorsey 1988

Many of these models share similar plant nutrient uptake functions. For example, the NLEAP functions are used in DRAINMOD-N, and the CREAMS subroutines are used in both the GLEAMS and ADAPT models. The plant uptake functions of these models were reviewed with respect to the following criteria, in order to evaluate their ability to be adapted to the HSPF AGCHEM module:

a. Assumptions related to transformations (i.e. first-order, monod, Michaelis-Menton)
b. Input parameters needed, and availability of data for estimation
c. Ability to simulate uptake from different soil layers, nitrogen fixation (for legumes), and uptake from both NO_3 and NH_4 pools
d. Allowable methods and forms for nutrient applications (fertilizers and manure)
e. Effect of moisture, temperature,and nutrients on crop growth and uptake
f. Calibration dependence
g. Model validation experience for nutrient uptake (N and P)
h. Ability to simulate plant growth, and double cropping
i. Timestep for simulation.

The original review included brief descriptions of the plant uptake functions for each of the major plant uptake functions used in the models reviewed, including NLEAP, CREAMS, OPUS, and EPIC (Donigian and Patwardhan 1994).

NLEAP Selection

Based on our review of the available plant uptake functions in current agricultural soil nutrient models and the current algorithm detail in AGCHEM, we selected **the plant uptake functions of the NLEAP model, to be adapted and incorporated into AGCHEM.** This selection was based on the following characteristics of the NLEAP plant nutrient uptake function:

- Calculates crop nutrient needs as a function of expected crop yield
- Allows seasonal uptake variation based on expected crop growth patterns
- Accommodates (or can be modified to accommodate) timesteps less than one day
- Considers both NO_3-N and NH_4-N as available for N uptake
- Considers N fixation, double cropping, and uptake from different soil layers
- Except for N fixation, the N uptake functions can be adapted for P uptake in AGCHEM
- Overall level of detail is consistent and compatible with AGCHEM

NLEAP model plant uptake functions

The following equation is used to calculate plant N uptake in NLEAP (Shaffer, Halvorson, and Pierce 1991):

$$N_{dmd} = YG*TNU*fNU*ITIME \tag{1}$$

where N_{dmd} = N uptake demand (lb/acre/time step)
YG = yield goal or maximum yield (lb/ac)
TNU = total N uptake (lb of N Uptake/lb of Yield)
fNU = fractional N uptake demand at the midpoint of the time step
ITIME = time step

The normalized curve that relates fNU to relative crop growth stage is shown in Figure 4. The value of fNU varies between 0 and 1, and is the average of fNU computed at the last time step and the current time step.

The N uptake demand is met between the upper and lower soil horizons, with the upper horizon corresponding to one foot (30.5 cm) and the lower horizon extending to the bottom of the root zone. NLEAP assumes that if the crop roots are present only in the top 30 cm of the soil, then 100% of the nitrogen uptake demand is met from the top soil layer. If the crop roots extend to 60 cm of the soil profile, then 90% of the nitrogen uptake is from the top 30 cm, and 10% from the bottom horizon of the soil profile. When crop roots penetrate more than 60 cm into the profile, then it is assumed that 80% of the nitrogen uptake is from the top 30 cm, and 20% from the lower horizon.

The nitrogen that is available for uptake from the upper soil horizon is computed as follows:

$$N_{avail1} = NAF + N1T1 \tag{2}$$

where NAF is the NH_4-N content and N1T1 is the NO_3-N content in the upper soil horizon. From the lower soil horizon, it is computed as

$$N_{avail2} = N1T2 \tag{3}$$

where N1T2 is the NO_3-N content in the lower horizon (lb/acre). Thus, uptake from the lower horizon is restricted to NO_3-N. The nitrogen uptake in each layer is

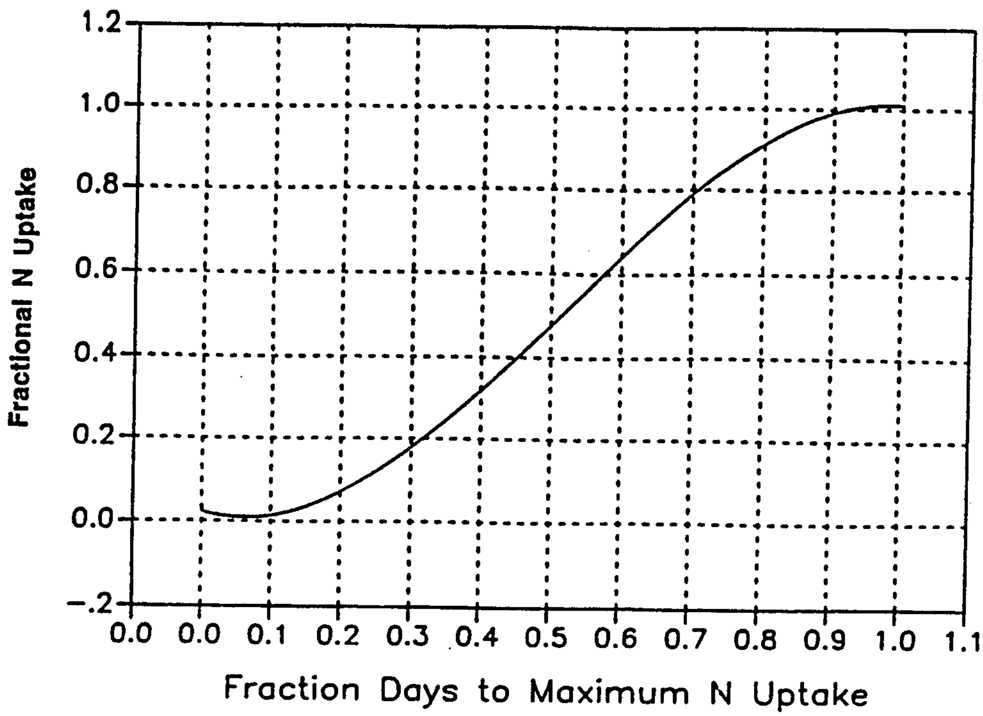


Figure 4. NLEAP fNU function for plant uptake

constrained by N availability in that layer. Therefore, N_{plt} is set equal to the smaller of N_{dmd} or (N_{avail1} + N_{avail2}) (Shaffer, Halvorson, and Pierce 1991).

Soil N uptake by legumes is taken as either the N demand by the crop or the sum of N_{avail1} and N_{avail2}, whichever is smaller. If the N demand is greater that the N available in soil, the plant is assumed to obtain the difference from N_2 fixation.

The NLEAP plant uptake subroutines are designed to allow the user to consider multiple cropping periods and alternative forms of nutrient inputs, such as urea or UAN (urea-ammonium-nitrate solution), ammonium sulfate, ammonium nitrate, and anhydrous ammonia. The manual allows the user to estimate and deduct from the application the amount of ammonia loss from fertilizer N applications, based on application methods, soils and climate scenarios (Meisinger and Randall 1991).

Adaptation of NLEAP for HSPF/AGCHEM

Due to differing hydrology, soil moisture, and soil profile simulation procedures between NLEAP and AGCHEM, and the conceptual differences between the HSPF watershed and NLEAP field-scale approaches, the NLEAP plant N uptake functions required adaptation in order to be consistent and compatible with HSPF/AGCHEM.. The changes primarily provided greater user flexibility in defining the timing and distribution of plant uptake from the individual soil layers, whose depths are also user-specified in HSPF, and to represent a wider potential range of watershed conditions.

To adapt the NLEAP approach to the AGCHEM and HSPF model structure, the following adjustments were implemented:

a. Total annual yield is specified in terms of a target N and P uptake, so that the yield goal (YG) in NLEAP is not needed.

b. The fNU function is replaced with 12 monthly values (user-defined), along with planting and harvesting dates, to define the target uptake variability during the year (i.e. uptake curve). This is a more flexible approach, consistent with AGCHEM/HSPF and facilitates multiple cropping by accepting multiple sets of planting and harvesting dates.

c. In place of the rigidly defined rules for uptake fractions from the upper and lower soil layers in NLEAP, we have incorporated the capability for the user to define the fraction of the total daily uptake demand that is derived from each of the four soil zones in AGCHEM. Thus, the user specifies 12 monthly values for each soil zone that control how much of the total uptake is calculated from that zone.

d. NLEAP does not account for moisture or temperature stress conditions, and possibly because of this, it tends to predict relatively constant annual uptake based on our limited discussions with model users. We have included moisture stress by stopping uptake when soil moisture is less than wilting point for each soil layer. Discussions with a few researchers have indicated that temperature stress is not important by itself; its impact is mostly on reducing moisture and then the moisture stress impact is considered. Temperature mostly impacts the availability of N through the other mechanisms e.g. nitrification, mineralization, for which the temperature adjustments are already considered in the model.

e. When stress conditions occur, we keep track of the nutrient deficit, i.e. the amount of unsatisfied nutrient demand, and allow enhanced uptake if additional nutrients become available, such as through fertilizer/manure applications or atmospheric deposition. This is implemented by having the user define the ratio of the maximum allowable uptake to the target uptake; the daily (and timestep) uptake will not be allowed to exceed this limit.

New Yield-Based Plant Uptake Option in AGCHEM

In the new yield-based plant nutrient uptake formulation in AGCHEM, a total annual target, NUPTGT, is specified by the user, and is then divided into monthly targets during the crop growing season for each soil layer. The monthly target for each soil layer is calculated as:

$$\text{MONTGT} = \text{NUPTGT* NUPTFM(MON)* NUPTM(MON)* CRPFRC(MON,ICROP)}$$

where:

MONTGT	=	monthly plant uptake target for current crop, mass N/area
NUPTGT	=	total annual uptake target, mass N/area
NUPTFM	=	monthly fraction of total annual uptake target, dimensionless
NUPTM	=	soil layer fraction of monthly uptake target, dimensionless
CRPFRC	=	fraction of monthly uptake target for current crop, dimensionless. This is 1.0, unless the month contains parts of two or more crop seasons, in which case the monthly uptake target is divided among the crops according to the number of days of the month belonging to each crop season.
MON	=	current month
ICROP	=	index for current crop

Planting and harvesting dates can be specified for up to three separate crops during the year. Plant uptake is assumed to occur only during a growing season, defined as the time period between planting and harvest. When portions of two growing seasons are contained within one month, the total monthly target is divided between the two crops in proportion to the number of days in each season in that month. The daily target is calculated by starting at zero at the beginning of a crop season and using a trapezoidal rule to solve for monthly boundaries; linear interpolation is used to solve for daily values between the monthly boundaries, and between a monthly boundary and a planting or harvest date.

Yield-based plant uptake only occurs when the soil moisture is above the wilting point, which is specified by the user for each soil layer, and sufficient nutrients are available. No temperature rate adjustment is performed, but all uptake is stopped when soil temperature is below 4 degrees C. If the uptake target is not met during a given interval, whether from nutrient, temperature, or moisture stress, then a deficit is accumulated, and applied to the next interval's target. When uptake later becomes possible, the program will attempt to make up the deficit by taking up nitrogen at a rate higher than the normal daily target, up to a user-specified maximum defined as a multiple of the target rate. The deficit is tracked for each soil layer, and is reset to zero at harvest, i.e. it does not carry over from one crop season to the next.

When using the yield-based plant uptake option, it is also possible to represent leguminous plants (e.g. soybeans) that will fix nitrogen from the atmosphere. The algorithm is designed to allow N fixation only to make up any shortfall in soil nitrogen, i.e. fixation is only allowed if the available soil nitrogen (i.e. nitrate and solution ammonium) is insufficient to satisfy the target uptake. The maximum daily nitrogen fixation rate is subject to the same limits as the uptake under deficit conditions noted above.

The version of AGCHEM included with HSPF Version No. 11 (Bicknell et al 1995 -- to be released in late 1995) allows three optional formulations for plant uptake: first-order (current formulation in HSPF No. 10), the new yield-based algorithm, and a saturation kinetics (i.e. Michaelis-Menton) approach recommended for forested conditions. The saturation kinetics approach is being implemented and tested under a joint USGS/EPA effort to improve AGCHEM for representing N mass-balance modeling for forested areas at the watershed scale. The saturation kinetics approach was recommended in a report by Oak Ridge National Laboratory as part of this joint

effort (Hunsaker, Garten, and Mulholland 1994).

New AGCHEM Module Input Parameters

The modified and new parameter tables for nitrogen required for the yield-based plant uptake option in AGCHEM are listed below:

NIT-FLAGS	Additional flags added for plant uptake options and N fixation
SOIL-DATA2	Wilting point values for each soil layer -- **NEW TABLE**
CROP-DATES	Planting and harvesting dates for up to three crops -- **NEW TABLE**
NIT-YIELD	Optimum yield target and allowable ratio of max to target daily uptake -- **NEW TABLE**
MON-NUPT-FR1	Monthly fractions to distribute the annual yield target over 12 months -- **NEW TABLE**
MON-NUPT-FR2	Monthly fractions to distribute the calculated daily yield target for each soil layer -- **NEW TABLES,** one for each of the four soil layers

The corresponding required phosphorus tables are:

PHOS-FLAGS, PHOS-YIELD, MON-PUPT-FR1, MON-PUPT-FR2

The specific parameter names and formats are described in the updated HSPF User Manual for Version No. 11(Bicknell et al. 1995); Table 1 shows an example of the nitrogen parameter tables and values for the Shenandoah model test segment. Note that any line with three asterisks (***) are comment lines used to help clarify and explain the model input; they are not read by the code.

Estimating Parameter Values

A variety of information sources need to be utilized to properly estimate the needed model parameters. Much of the information needed for testing the AGCHEM yield-based uptake was originally derived in the initial Phase II Watershed Model effort (Donigian et al. 1994). Below we discuss a few of the information sources and issues involved estimating uptake parameters.

In table **NIT-FLAGS**, two additional flags have been added for selection of the uptake option to use and activation of nitrogen fixation. The uptake flag options are as follows:

NUPTFG=1	First-order uptake
NUPTFG=2	Yield-based uptake
NUPTFG=3	Saturation kinetics uptake (implemented for N only)

The N fixation flag, NFIXFG, activates the fixation process when it is set to 1; it can be used with either the yield-based or saturation kinetics uptake options.

Table 1. New Nitrogen Parameter Tables Needed For Yield-Based Plant Uptake (example from Shenandoah UCI)

```
NIT-FLAGS
  <PLS > NITROGEN FLAGS    ***
  # -  # VNUT FORA ITMX BNUM CNUM NUPT FIXN    ***
192  196          1  100    3    1    1
202  206          1  100    3    1    1
END NIT-FLAGS

 SOIL-DATA2
  <PLS >     SWILTP    UWILTP    LWILTP    AWILTP ***
  # -  #    (IN/IN)   (IN/IN)   (IN/IN)   (IN/IN) ***
192  196       0.01      0.02      0.05      0.18
202  206       0.01      0.02      0.05      0.18
END SOIL-DATA2

CROP-DATES
  <PLS >              CROP 1           CROP 2            CROP 3       ***
  # -  # NCRP      PM PD   HM HD    PM PD   HM HD    PM PD   HM HD ***
192  196    1       1  1   12 31
202  206    1       1  1   12 31
END CROP-DATES

NIT-YIELD
  <PLS >     NUPTGT    NMXRAT ***
  # -  #    (LB/AC)           ***
192          145.00       2.0
193          155.00       2.0
196           60.00       2.0
202          155.00       2.0
203          155.00       2.0
206           60.00       2.0
END NIT-YIELD

MON-NUPT-FR1
  <PLS >  Monthly fractions for plant uptake target                        ***
  # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC ***
192  196 .013  .03  .05  .07  .13  .19  .20  .15 .085  .05 .028 .004
202  206 .013  .03  .05  .07  .13  .19  .20  .15 .085  .05 .028 .004
END MON-NUPT-FR1

MON-NUPT-FR2
  <PLS >  Monthly fractions for plant uptake target from surface           ***
  # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC ***
192  196  .01  .01  .01  .01  .01  .01  .01  .01  .01  .01  .01  .01
202  206  .01  .01  .01  .01  .01  .01  .01  .01  .01  .01  .01  .01
END MON-NUPT-FR2

MON-NUPT-FR2
  <PLS >  Monthly fractions for plant uptake target from upper             ***
  # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC ***
192  196  .56  .56  .56  .56  .56  .56  .44  .35  .35  .35  .56  .56
202  206  .56  .56  .56  .56  .56  .56  .44  .35  .35  .35  .56  .56
END MON-NUPT-FR2

MON-NUPT-FR2
  <PLS >  Monthly fractions for plant uptake target from lower             ***
  # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC ***
192  196  .43  .43  .43  .43  .43  .43  .55  .64  .64  .64  .43  .43
202  206  .43  .43  .43  .43  .43  .43  .55  .64  .64  .64  .43  .43
END MON-NUPT-FR2
```

In table **SOIL-DATA2**, wilting point values (volume basis, or inch moisture/inch of depth) are specified for each soil zone as a threshold for moisture stress conditions. Wilting point (or 15-bar soil moisture) information is often tabulated as a function of soil texture, and can be found in local soil surveys, from the County Extension Service, or published literature (e.g. Rawls, Brakensiek, and Saxton 1982; Mullins et al. 1993). Since the surface soil layer only contains moisture during runoff, it will normally be in a moisture stress condition leading to very little nutrient uptake from this layer.

Table **CROP-DATES** includes the planting and harvesting dates for up to three annual crops. Data from local agronomists or agricultural agencies is probably the best source, and a standard national reference is the U.S. Department of Agriculture Handbook No. 628 entitled "Usual Planting and Harvesting Dates for U.S. Field Crops" (U.S.D.A. 1984).

Tables **NIT-YIELD** and **PHOS-YIELD** include the target yields (in terms of N and P uptake) and ratios of daily maximum to daily target uptake rates for N and P, respectively. The target yields are essentially the maximum, or optimum, values of N and P taken up by the plant, as the algorithm will not calculate values in excess of these targets. Donigian et al (1994) developed expected yield ranges for selected crops for the Phase II Chesapeake Bay Watershed Model effort based on variety of literature sources and state-level crop yield information. Local yield data combined with N and P uptake estimates from standard agronomic references (e.g. Tisdale, Nelson, and Beaton 1985; Meisinger and Randall 1991) can be used to develop these targets for local site conditions.

For the ratio of maximum to target daily uptake rates, guidance needs to be developed from the plant physiology literature. Current values of 1.5 to 5.0 are expected, with the values for N greater than those for P, pending further literature review and analysis.

In Tables **MON-NUPT-FR1** and **MON-PUPT-FR1**, monthly fractions of the annual target uptake for N and P are used to distribute the annual amount over the year. Based on local information, or using planting/harvest dates and S-curve uptake pattern from NLEAP (Figure 4), the monthly fractions can be estimated to provide the desired uptake curve.

Tables **MON-NUPT-FR2** and **MON-PUPT-FR2** are specified up to four times each for N and P, respectively, to define the fraction of the daily uptake target derived from each of the four soil layers. Typically, uptake from the groundwater layer is set to zero, and uptake from the surface is relatively small as it is usually under moisture stress conditions except when runoff is occurring. Thus the majority of the uptake is derived from the upper and lower soil zones, with the upper soil zone dominating during the early growing season and the lower zone becoming a greater source during the latter part of the season. As these depths are specified by the user, the actual depth values used must be considered when deriving the layer fractions.

3 Testing the New Yield-Based AGCHEM Plant Uptake Routine

Introduction

The new yield-based nutrient uptake routines in AGCHEM were tested on the Shenandoah, Monocacy, and West Branch Susquehanna model segments, shown in Figure 1. These segments were selected for their diversity of location and presence of agricultural cropland as a major portion of the drainage area. The testing focussed on the evaluation of the new uptake routines, but also included other enhancements to the modeling that were included as part of the refinements under Phase III of the CBP Watershed Model. These refinements included the following:

a. Activation of direct atmospheric deposition linkages for selected nutrients for the cropland model segments simulated with AGCHEM.

b. Utilization of Enhanced SPECIAL ACTIONS capabilities to improve the nutrient application procedures and reduce the length of the model input.

These changes are discussed below along with the results of the model testing. It should be noted that testing primarily involved evaluating the behavior of the algorithm through sensitivity analyses, and comparing the new routine predictions to those using the first-order option employed in Phase II. Except for the changes noted above, the model representation was the same as in Phase II, including the composite crop, with the primary difference being the new yield-based uptake algorithm.

Atmospheric Deposition and SPECIAL ACTIONS Enhancements

Atmospheric Deposition

In HSPF Version No. 11 (Bicknell et al. 1995), atmospheric deposition (AD) can be added as a dry or total deposition flux in lbs/ac, and/or as wet deposition as a concentration (timeseries or monthly values) that is multiplied by precipitation; for our testing we used the existing AD timeseries as the total deposition flux. As part of the AGCHEM testing on the Shenandoah, Monocacy and West Branch Susquehanna, we used the new atmospheric deposition (AD) capabilities of HSPF No. 11 to replace the procedures in Phase II that added this component as part of the fertilizer and manure

applications. Consequently, as part of this effort to convert the Phase II model input to Phase III, we deleted the AD component of nitrogen from the SPECIAL ACTIONS block of the model input, where it was combined with the nutrient applications, and implemented the direct linkage of the AD timeseries (WDM datasets) with the corresponding soil storages for the AGCHEM segments -- CNT, CST, HAY.

Also, in Phase II all AD of N for the AGCHEM segments was assumed to be in NO_3 form. In this step, we re-calculated the new AGCHEM NO_3 application rate, i.e. without AD, and modified SPECIAL ACTIONS accordingly so that only fertilizer and manure components were represented.

Enhanced SPECIAL ACTIONS and AGCHEM Output

Under funding by both the U.S. EPA and U.S. Geological Survey, a number of enhancements have been implemented over the past few years to the SPECIAL ACTIONS of HSPF Version No. 11 (Bicknell et al. 1995). These enhanced capabilities include a number of options that allow for a much more compact UCI (HSPF User's Control Input, or model input) by making this block much shorter, and allow for a better representation of agricultural practices and conditions. The primary options we used in this effort include the following:

a. **REPEAT** function -- duplicates selected actions each year, and eliminates the need to repeat specification of the annual actions in the UCI.

b. **DISTRB** function -- allows a single action (e.g. application) to be split into multiple applications over a defined time period. This is being used to distribute fertilizer applications over a 5-day application 'window'.

c. **UVNAME** function -- allows a user-defined variable name to activate a pre-defined series of actions; this is used to distribute a total nutrient application into the appropriate soil layers without the need to specify each soil layer for each application.

d. **CONDITIONAL** function -- allows the user to have the program check to see if a specific condition exists, such as if rainfall is greater than 0.1 inches, and then the SPECIAL ACTION (either one or a group) can be performed if the condition is **'true'**, or skipped if it is **'false'**. This is currently used to avoid fertilizer applications on days with significant rainfall.

In addition, the AGCHEM output summary now also shows the total AD for each nutrient form, and the applied amounts of each nutrient form as defined in the SPECIAL ACTIONS block.

AGCHEM Testing Results

Table 2 shows a comparison of the nutrient uptake and runoff results for the 1984-87 period for all three cropland AGCHEM segments for the Upper Shenandoah model

segment 190 using both the first-order uptake option (as used in Phase II) and the new yield-based plant uptake routines. Figure 5 shows the annual uptake curves for Conventional Tillage for 1984-87 for both options for the same conditions. Tables 3, 4, and 5 show AGCHEM summaries for the three cropland segments for the Upper Shenandoah, while Appendix A includes complete results for all three test model segments and for the entire simulation period of 1984-91.

The results in Table 2 indicate that the new yield-based plant uptake option can produce essentially the same uptake amounts as the original first-order approach; the two uptake amounts are either identical or within a few percent. The only exception was for the Hay segment where the first-order uptake of P was below the expected range, so the uptake target was increased to correct for this discrepancy.

Runoff amounts are slightly less under the yield-based option for most nutrient variables. However, the sediment associated organic nutrients increased due to small differences in the precipitation timeseries (from Phase II to Phase III) which produced minor runoff differences but much greater differences for sediment and associated nutrients. Thus, the differences were not due to the new algorithm.

The annual N uptake curves shown in Figure 5 for both options indicate that the annual patterns are similar, and the yield-based option is somewhat less variable. This is to be expected as the yield-based option is designed to be limited by available nutrients but not a direct function of the available amount. Figure 6 shows the full eight-year simulation of N uptake for Conventional Tillage in the Shenandoah, along with the calculated N deficit variability during each year.

Tables 3, 4, and 5 are examples of tables produced by a separate program (called OUTSUM) developed to read the standard HSPF output and summarize important variables and fluxes for use in calibration and alternative scenario evaluation. New variables and fluxes shown in these tables that were added to HSPF Version No. 11 include atmospheric deposition, nutrient application form and amounts, and plant uptake deficits. These are key components in identifying the nutrient balance simulated by AGCHEM and comparing these components to observed data or expected ranges.

Sensitivity to Application Rates

Table 6 shows the results of sensitivity runs varying the N and P application rates by 20%. Increasing the application rates by 20% leads to a 37% increase in N runoff and a 16% increase in P runoff; whereas a 20% decrease in rates leads to a 26% decrease in N runoff and a 13% decrease in P runoff.

With respect to uptake amounts, the 20% increase leads to a 3% increase in N uptake and no significant increase in P uptake, demonstrating the design of the yield-based function to be relatively insensitive to application rates. However, the 20% decrease in application rates produces a 15% decrease in N uptake but no significant change in P uptake. The decrease is a direct result of the form of N application; with a 20% decrease in the Total N application rate, the amount of plant available N (i.e. ammonia and nitrate) is reduced to about 123 lb/ac or 70% of the total, and is less than the needed plant uptake. The same condition does not occur for P because even

Table 2. AGCHEM Model Results for First-Order and Yield-Based Plant Uptake Options for Cropland in Upper Shenandoah Model Segment 190, 1984-87 (lb/ac)

	Conventional Tillage		Conservation Tillage		Hay	
	First-Order	Yield-Based	First-Order	Yield-Based	First-Order	Yield-Based
Runoff Losses						
NO_3	17.49	15.09	15.45	12.25	4.44	3.40
NH_3	3.75	3.63	3.68	3.58	0.54	0.54
Org N	5.03	5.03	4.37	4.37	1.62	1.62
Total N	26.26	23.75	23.50	20.21	6.61	5.56
PO_4	2.29	2.14	2.08	1.93	0.94	0.90
Org P	1.40	1.40	1.17	1.17	0.45	0.45
Total P	3.69	3.54	3.26	3.10	1.38	1.35
Plant Uptake						
N	130.1	133.9	136.3	143.1	45.6	45.8
P	22.9	23.6	22.7	23.3	13.2	18.7
Nutrient Applications						
N	213.8	213.8	217.3	217.4	44.4	44.4
NO_3	29.1	29.1	30.0	30.0	7.3	7.3
NH_3	127.9	127.9	130.6	130.6	28.3	28.3
Org N	56.8	56.8	56.8	56.8	8.8	8.8
P	59.1	59.1	58.3	58.3	30.8	30.8
PO_4	43.8	43.8	43.0	43.0	27.5	27.5
Org P	15.3	15.3	15.3	15.3	3.3	3.3

Table 3. AGCHEM Summary Results for Conventional Tillage in the Shenandoah Model Segment 192

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	43.65	42.99	30.45	43.61	40.17
Runoff (in)					
Surface	11.89	9.687	2.636	8.933	8.286
Interflow	3.631	3.752	1.582	3.289	3.063
Baseflow	6.611	5.361	4.152	5.442	5.391
Total	22.13	18.80	8.369	17.66	16.74
Sediment Loss (t/a)	1.390	2.370	0.2770	1.560	1.399
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	1.181	0.4099	0.2172	0.4990	0.5768
Interflow	12.93	13.58	8.011	11.73	11.56
Baseflow	2.975	2.346	2.439	4.034	2.949
Total	17.09	16.33	10.67	16.27	15.09
NH3 Loss					
Surface	4.554	0.6716	0.8936	1.356	1.869
Interflow	1.353	1.781	1.518	2.262	1.729
Baseflow	0.3573E-01	0.9326E-02	0.3888E-02	0.3509E-02	0.1311E-01
Sediment	0.1642E-01	0.2475E-01	0.3416E-02	0.1687E-01	0.1536E-01
Total	5.959	2.487	2.419	3.638	3.626
ORGN Sediment	4.841	8.743	1.020	5.521	5.031
Total N Loss (lb/a)	27.89	27.56	14.11	25.43	23.75
PO4 Loss					
Surface	1.747	0.8882	0.8893	1.005	1.132
Interflow	0.5706	1.181	0.6109	1.360	0.9306
Baseflow	0.6270E-03	0.7579E-05	0.4806E-05	0.8252E-05	0.1619E-03
Sediment	0.7212E-01	0.1254	0.1830E-01	0.8645E-01	0.7557E-01
Total	2.391	2.195	1.519	2.451	2.139
ORGP Sediment	1.342	2.445	0.2823	1.534	1.401
Total P Loss (lb/a)	3.733	4.639	1.801	3.985	3.539
Atm Depn. NO3 (lb/a)	6.639	6.417	6.019	6.635	6.428
Atm Depn. NH4 (lb/a)	2.245	2.070	1.775	2.204	2.074
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	126.0	129.0	127.7	129.0	127.9
Nitrate appln.(lb/a)	28.48	29.46	29.05	29.46	29.11
ORGN appln.(lb/a)	56.76	56.76	56.76	56.76	56.76
Total N appln.(lb/a)	211.3	215.2	213.5	215.2	213.8
PO4-P appln.(lb/a)	42.60	44.39	43.65	44.39	43.76
ORGP appln.(lb/a)	15.30	15.30	15.30	15.30	15.30
Total P appln.(lb/a)	57.91	59.69	58.95	59.69	59.06
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.1000E-01	0.1600E-01	0.5000E-02	0.1000E-01	0.1025E-01
Upper	75.22	73.86	79.48	83.89	78.11
Lower	51.98	57.08	57.08	57.08	55.81
Total	127.2	131.0	136.6	141.0	133.9
Phosphorus					
Surface	0.8000E-02	0.1200E-01	0.3000E-02	0.8000E-02	0.7750E-02
Upper	19.58	19.92	19.93	19.91	19.83
Lower	3.753	3.752	3.752	3.752	3.752
Total	23.34	23.68	23.69	23.67	23.59

Table 3. AGCHEM Summary Results for Conventional Tillage in the Shenandoah Model Segment 192 (Continued)

	1984	1985	1986	1987	SUM/AVER
Deficit (lb/a)					
Nitrogen					
Surface	1.441	1.435	1.446	1.441	1.441
Upper	11.61	12.97	7.396	2.966	8.736
Lower	5.196	0.0000	0.0000	0.0000	1.299
Total	18.25	14.40	8.842	4.407	11.47
Phosphorus					
Surface	1.243	1.238	1.247	1.243	1.243
Upper	0.4419	0.9227E-01	0.9982E-01	0.1092	0.1858
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	1.685	1.330	1.347	1.352	1.428
Other Fluxes-lb/ac					
N Mineralization	18.66	21.40	22.05	22.06	21.04
P Mineralization	2.496	2.487	2.502	2.459	2.486
Denitrification	3.351	4.699	6.258	6.860	5.292
N Immobilization	22.95	26.50	26.73	26.17	25.59
P Immobilization	12.99	21.38	17.73	20.46	18.14

Table 4. AGCHEM Summary Results for Conservation Tillage in the Shenandoah Model Segment 193

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	43.65	42.99	30.45	43.61	40.17
Runoff (in)					
Surface	10.09	8.250	1.916	7.327	6.896
Interflow	3.565	3.726	1.503	3.193	2.997
Baseflow	7.245	5.996	4.483	5.937	5.915
Total	20.90	17.97	7.901	16.46	15.81
Sediment Loss (t/a)	1.010	1.720	0.1750	1.050	0.9887
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.9321	0.2866	0.1423	0.3981	0.4398
Interflow	11.54	12.14	6.482	9.989	10.04
Baseflow	2.574	1.558	1.123	1.853	1.777
Total	15.04	13.99	7.747	12.24	12.25
NH3 Loss					
Surface	5.337	0.5397	0.9575	1.178	2.003
Interflow	1.153	1.573	1.356	2.145	1.557
Baseflow	0.3701E-01	0.8887E-02	0.3359E-02	0.3275E-02	0.1313E-01
Sediment	0.1171E-01	0.1792E-01	0.2089E-02	0.1123E-01	0.1074E-01
Total	6.538	2.140	2.319	3.337	3.583
ORGN Sediment	4.326	7.789	0.7913	4.571	4.369
Total N Loss (lb/a)	25.91	23.92	10.86	20.15	20.21
PO4 Loss					
Surface	2.150	0.8366	0.9565	1.064	1.252
Interflow	0.5270	0.6874	0.3784	0.9238	0.6292
Baseflow	0.6368E-03	0.6012E-05	0.2165E-05	0.2519E-05	0.1619E-03
Sediment	0.5165E-01	0.9029E-01	0.1169E-01	0.5676E-01	0.5260E-01
Total	2.729	1.614	1.347	2.045	1.934
ORGP Sediment	1.154	2.097	0.2111	1.222	1.171
Total P Loss (lb/a)	3.883	3.711	1.558	3.267	3.105
Atm Depn. NO3 (lb/a)	6.639	6.417	6.019	6.635	6.428
Atm Depn. NH4 (lb/a)	2.245	2.070	1.775	2.204	2.074
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	128.4	131.7	130.4	131.7	130.6
Nitrate appln.(lb/a)	29.30	30.41	29.95	30.41	30.02
ORGN appln.(lb/a)	56.76	56.76	56.76	56.76	56.76
Total N appln.(lb/a)	214.5	218.9	217.1	218.9	217.3
PO4-P appln.(lb/a)	41.67	43.69	42.85	43.69	42.98
ORGP appln.(lb/a)	15.30	15.30	15.30	15.30	15.30
Total P appln.(lb/a)	56.97	58.99	58.15	58.99	58.28
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.2800E-01	0.2400E-01	0.7000E-02	0.2500E-01	0.2100E-01
Upper	80.37	81.97	88.71	91.98	85.76
Lower	51.25	61.12	61.13	55.95	57.36
Total	131.6	143.1	149.9	148.0	143.1
Phosphorus					
Surface	0.1900E-01	0.1800E-01	0.5000E-02	0.1900E-01	0.1525E-01
Upper	18.93	19.50	19.91	19.90	19.56
Lower	3.753	3.752	3.752	3.752	3.752
Total	22.70	23.27	23.67	23.67	23.33

Table 4. AGCHEM Summary Results for Conservation Tillage in the Shenandoah Model Segment 193 (Continued)

	1984	1985	1986	1987	SUM/AVER
Deficit (lb/a)					
Nitrogen					
Surface	1.523	1.526	1.544	1.526	1.530
Upper	12.49	11.07	4.300	0.9946	7.214
Lower	9.928	0.0000	0.0000	5.153	3.770
Total	23.94	12.60	5.844	7.673	12.51
Phosphorus					
Surface	1.232	1.233	1.246	1.232	1.236
Upper	1.085	0.5133	0.9982E-01	0.1092	0.4518
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	2.317	1.746	1.346	1.341	1.687
Other Fluxes-lb/ac					
N Mineralization	18.81	22.25	22.89	22.01	21.49
P Mineralization	2.765	2.714	2.759	2.744	2.746
Denitrification	2.505	2.969	2.725	3.018	2.804
N Immobilization	23.54	27.70	27.90	27.21	26.59
P Immobilization	15.33	23.14	19.00	21.78	19.81

Table 5. AGCHEM Summary Results for Hay Cropland in the Shenandoah Model Segment 196

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	43.65	42.99	30.45	43.61	40.17
Runoff (in)					
Surface	9.811	7.853	1.582	6.630	6.469
Interflow	2.438	2.491	0.8270	2.157	1.978
Baseflow	7.159	5.821	4.034	5.650	5.666
Total	19.41	16.16	6.444	14.44	14.11
Sediment Loss (t/a)	0.7640	0.7510	0.1110	0.6820	0.5770
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.6038	0.3131	0.8451E-01	0.3273	0.3322
Interflow	1.081	0.8509	0.4196	1.028	0.8449
Baseflow	3.258	1.854	1.373	2.406	2.223
Total	4.943	3.018	1.877	3.762	3.400
NH3 Loss					
Surface	0.9890	0.3337	0.1478	0.3741	0.4611
Interflow	0.6058E-01	0.6783E-01	0.4962E-01	0.4995E-01	0.5700E-01
Baseflow	0.3678E-01	0.8706E-02	0.2978E-02	0.2619E-02	0.1277E-01
Sediment	0.8143E-02	0.7690E-02	0.1182E-02	0.7217E-02	0.6058E-02
Total	1.095	0.4179	0.2016	0.4339	0.5371
ORGN Sediment	2.127	2.138	0.3088	1.911	1.621
Total N Loss (lb/a)	8.165	5.574	2.388	6.107	5.559
PO4 Loss					
Surface	1.287	0.5291	0.3795	0.7280	0.7309
Interflow	0.1617	0.1372	0.5257E-01	0.2094	0.1402
Baseflow	0.6426E-03	0.4208E-05	0.8614E-06	0.4387E-06	0.1620E-03
Sediment	0.3867E-01	0.3871E-01	0.6658E-02	0.3872E-01	0.3069E-01
Total	1.489	0.7050	0.4387	0.9761	0.9022
ORGP Sediment	0.5728	0.5998	0.8567E-01	0.5226	0.4452
Total P Loss (lb/a)	2.061	1.305	0.5244	1.499	1.347
Atm Depn. NO3 (lb/a)	6.639	6.417	6.019	6.635	6.428
Atm Depn. NH4 (lb/a)	2.245	2.070	1.775	2.204	2.074
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	28.31	28.31	28.31	28.31	28.31
Nitrate appln.(lb/a)	7.320	7.320	7.320	7.320	7.320
ORGN appln.(lb/a)	8.760	8.760	8.760	8.760	8.760
Total N appln.(lb/a)	44.39	44.39	44.39	44.39	44.39
PO4-p appln.(lb/a)	27.48	27.48	27.48	27.48	27.48
ORGP appln.(lb/a)	3.360	3.360	3.360	3.360	3.360
Total P appln.(lb/a)	30.84	30.84	30.84	30.84	30.84
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.4000E-02	0.4000E-02	0.1000E-02	0.6000E-02	0.3750E-02
Upper	32.82	33.44	33.49	32.25	33.00
Lower	12.84	12.84	12.84	12.84	12.84
Total	45.66	46.28	46.33	45.09	45.84
Phosphorus					
Surface	0.8000E-02	0.8000E-02	0.2000E-02	0.1100E-01	0.7250E-02
Upper	15.94	15.94	15.94	15.93	15.94
Lower	3.002	3.001	3.001	1.924	2.732
Total	18.95	18.95	18.94	17.86	18.68

Table 5. AGCHEM Summary Results for Hay Cropland in the Shenandoah Model Segment 196 (Continued)

	1984	1985	1986	1987	SUM/AVER
Deficit (lb/a)					
Nitrogen					
Surface	0.4959	0.4959	0.4994	0.4945	0.4964
Upper	3.910	3.292	3.236	4.462	3.725
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	4.406	3.788	3.735	4.957	4.222
Phosphorus					
Surface	0.9928	0.9924	0.9988	0.9895	0.9934
Upper	0.8367E-01	0.7382E-01	0.7985E-01	0.8734E-01	0.8117E-01
Lower	0.0000	0.0000	0.0000	1.077	0.2693
Total	1.076	1.066	1.079	2.154	1.344
Other Fluxes-lb/ac					
N Mineralization	19.27	19.33	19.17	18.95	19.18
P Mineralization	2.342	2.351	2.244	1.954	2.223
Denitrification	4.162	3.366	3.511	4.291	3.832
N Immobilization	8.629	9.451	9.354	9.358	9.198
P Immobilization	11.51	13.02	9.969	12.05	11.64

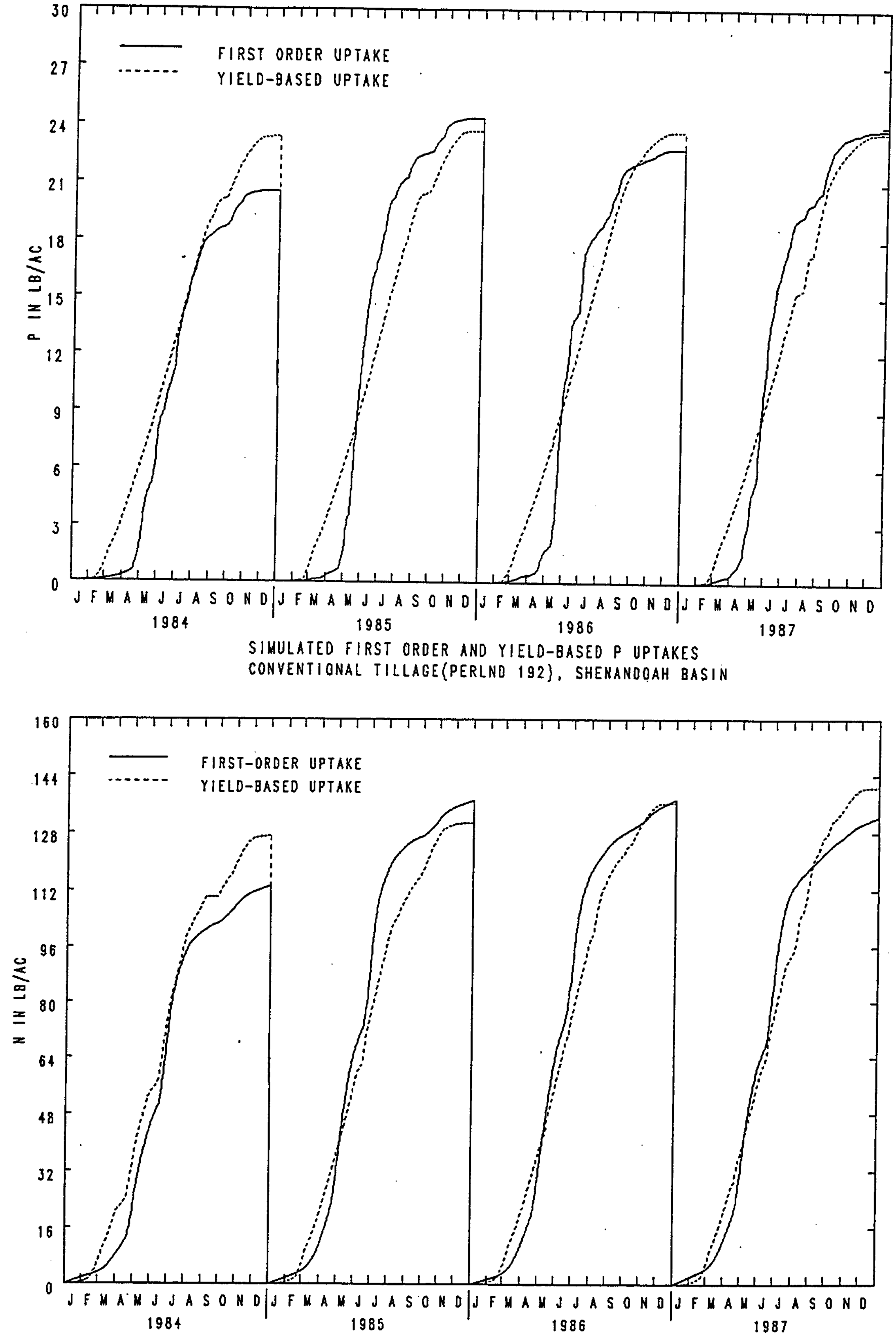


Figure 5. **Comparison of first-order and yield-based plant uptake options for conventional tillage in the shenandoah model segment**

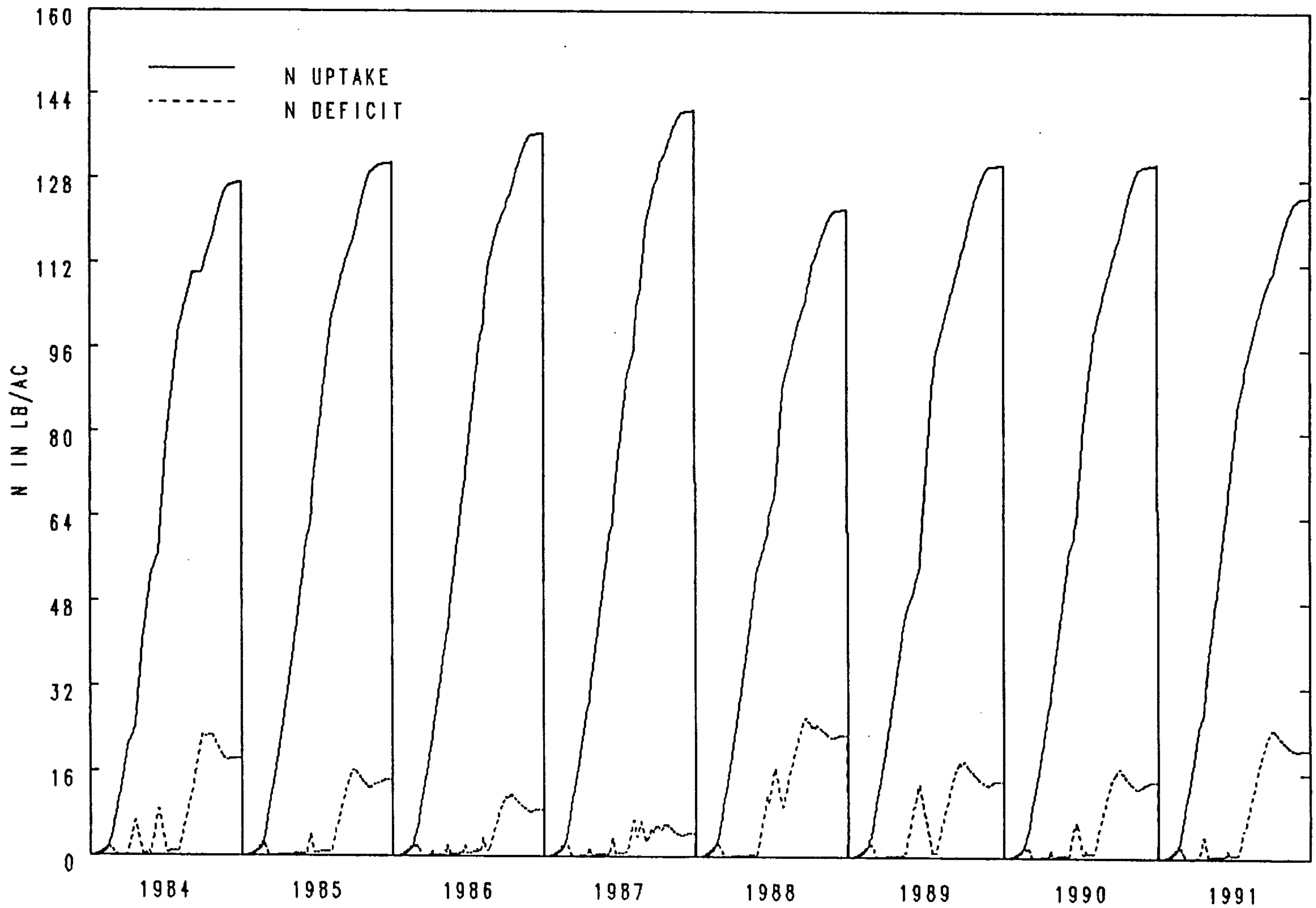


FIGURE 6. SIMULATED PLANT N UPTAKE AND DEFICITS FOR CONVENTIONAL TILLAGE IN THE SHENANDOAH MODEL SEGMENT, 1984-91

Table 6. Impacts of Changes in Application Rates for Conventional Tillage in the Upper Shenandoah Model Segment 190, 1984-87 (lb/ac)

	Conventional Tillage	20 % Increase	20% Decrease	20% Decrease with Org N/P Converted to NH_3/PO_4
Runoff Losses				
NO_3	15.09	23.26	9.62	18.73
NH_3	3.63	4.23	3.04	5.10
Org N	5.03	5.10	4.96	4.69
Total N	23.75	32.59	17.62	28.52
PO_4	2.14	2.68	1.69	2.81
Org P	1.40	1.42	1.38	1.31
Total P	3.54	4.10	3.07	4.12
Plant Uptake				
N	133.9	137.4	115.4	132.6
P	23.6	23.7	23.4	23.7
Nutrient Applications				
N	213.8	256.5	171.7	171.7
NO_3	29.1	34.9	23.3	23.3
NH_3	127.9	153.5	102.9	148.4
Org N	56.8	68.1	45.5	0.0
P	59.1	70.9	49.4	49.4
PO_4	43.8	52.5	37.2	49.4
Org P	15.3	18.4	12.2	0.0

with the 20% reduction, the plant available P (i.e. PO_4) is still about 37 lb/ac and is adequate to meet the plant needs.

To confirm this behavior, the 20% reduction condition was redone with all organic N and P converted to NH_3 and PO_4. As shown in the last column in Table 6, conversion of the organics results in plant uptake returning to the desired levels. **This demonstrates that the yield-based function will attempt to meet target demands, but that the nutrients must be in a plant available form.** Otherwise, a nutrient stress condition will result and will lead to deficit conditions with uptake less than needed. Nutrient management efforts will need to consider alternative scenarios of changes in fertilizer and manure applications in order to ensure that sufficient plant available nutrients are applied to meet crop needs.

Sensitivity to Nutrient Target Rates

Table 7 shows the impact of a 20% increase and decrease in the N and P target rates for the Conventional Tillage land use in the Shenandoah model segment 190. The target rates used in these runs were as follows:

N and P Target Uptake Rates (lb/ac)

	Base Condition	20 % Increase	20% Decrease
N	145	174	116
P	25	30	20

The 20% increase leads to a smaller increased uptake than the target increase due to the limiting impact of the available plant nutrients, even though total applications are sufficient to meet the target levels. The 20 % decrease in target levels leads to plant uptake levels reduced by almost the same percentage for N and the identical 20% decrease for P. In this case, there are sufficient plant available nutrients to meet the lower demand, and the result is significantly greater runoff amounts -- almost 30% greater for N and almost 10% greater for P. These runs also demonstrate that the target levels are effectively maximum, or optimum levels, that are not fully satisfied in these simulations. Moisture stress in the surface layer, nutrient stress associated with the uptake occurring from the solution form of NH_3 and PO_4, and the defined distribution of the uptake target between NH_3 and NO_3 all lead to uptake levels somewhat below the target. Thus, target levels should be set to 10% to 20% above desired uptake levels based on our experience in this effort.

Conclusions and Recommendations

Conclusions

The addition of a yield-based plant uptake option in the AGCHEM module of HSPF, derived from the NLEAP uptake formulation, provides an improved algorithm for representing the plant uptake component of nutrient balances for agricultural croplands. The new algorithm allows for direct consideration of expected plant yield levels for both N and P, seasonal distribution of uptake rates and multiple cropping periods, N fixation by leguminous plants, and stress conditions related to available

nutrient levels and moisture conditions. Nutrient deficit state conditions are assessed and enhanced uptake is allowed when additional nutrients become available. In this option, soil temperature is only considered as a threshold as uptake is stopped below 4°C. High temperatures leading to low moisture conditions are indirectly considered when uptake is inhibited below soil wilting point levels.

Testing of the algorithm shows that it is sensitive to the available plant nutrients in the soil layers and to the target levels defined by the user corresponding to expected crop yields. The formulation is definitely less sensitive than the first-order option to nutrient application rates. Increasing application rates results in increased uptake but only up to the user-defined target levels; whereas, when application rates are decreased, the algorithm attempts to still meet the defined target levels, subject to the simulated stress conditions. Our testing has shown that decreased application rates will allow uptake levels to remain unchanged **only if** the plant available nutrients (from applications, atmospheric deposition, and mineralization) are sufficient to satisfy plant needs. This has important implications for agricultural BMPS that include nutrient reduction components.

Recommendations

Although all components and capabilities of the new yield-based plant uptake option in AGCHEM have been tested for proper operation, not all have been tested under site and crop specific conditions. The 'composite crop' employed in the CBP Watershed Model, derived from parameters weighted by cropping distributions within each model segment, precluded detailed testing for individual crops and small-scale field conditions. Further testing at this level is recommended for evaluation of N fixation by leguminous crops, multiple cropping conditions, uptake timing and plant nutrient levels, and representation of stress conditions (i.e. nutrient and moisture). Small instrumented field sites, such as those in the Patuxent Basin (R. Summers, personal communication, 1994), the Nomini Creek/Owl Run sites in Virginia, the Conestoga basin in PA, and U.S.D.A. sites in Walnut Creek, IA should be considered for future testing and evaluation of the new yield-based algorithm.

Table 7. Impacts of Changes in Nutrient Target Rates for Conventional Tillage in the Upper Shenandoah Model Segment 190, 1984-87 (lb/ac)

	Conventional Tillage	20 % Increase	20% Decrease
Runoff Losses			
NO_3	15.09	11.70	21.98
NH_3	3.63	3.64	3.64
Org N	5.03	5.03	5.03
Total N	23.75	20.37	30.64
PO_4	2.14	2.00	2.30
Org P	1.40	1.40	1.40
Total P	3.54	3.40	3.70
Plant Uptake			
N	133.9	137.9	110.6
P	23.6	27.4	18.9
Nutrient Applications			
N	213.8	213.8	213.8
NO_3	29.1	29.1	29.1
NH_3	127.9	127.9	127.9
Org N	56.8	56.8	56.8
P	59.1	59.1	59.1
PO_4	43.8	43.8	43.8
Org P	15.3	15.3	15.3

4 Testing and Calibration of the Refined Watershed Model

Model Testing Procedures

Testing and calibration of the refined Watershed Model for the three selected test segments involved:

a. Review and evaluation of the AGCHEM cropland simulations
b. Review and comparison of nonpoint source loadings from all land use categories
c. Calibration of selected instream water quality parameters based on comparison of simulated and observed concentrations

The refined Watershed Model resulting from this effort for the three test segments differs from the earlier Phase II Watershed Model in the following ways:

a. Land use was updated by CBPO to 1990 conditions (Neumiller at al. 1994)
b. Selected model segments were re-defined for finer spatial detail
c. Precipitation and meteorologic data was reviewed and extended through 1991
d. Point sources, diversion, and atmospheric deposition files were extended through 1991
e. The yield-based plant uptake function was used in AGCHEM
f. Enhanced SPECIAL ACTIONS capabilities were used to reduce the length of the model input and improve representation of chemical application practices
g. Atmospheric deposition was included as timeseries directly input to chemical storages for the AGCHEM segments, taking advantage of additional HSPF Version No. 1 capabilities

In addition, as part of the water quality calibration, benthic oxygen demand and benthic algae processes were activated within HSPF in order to improve the low DO and inorganic nutrient simulation. These processes had been included in earlier versions of HSPF but had not been 'turned on' due to the focus of developing loads to the Bay versus local water quality conditions within model segments.

In spite of these many differences, the two versions are essentially similar with the refined version extending the simulation through 1991 and incorporating a number of refinements that have helped to improve the simulations and its utility for evaluating nutrient management.

Nonpoint Source and Loading Assessment

The loading assessment involved reviewing the contaminant loadings for each constituent for each source, including nonpoint sources, point sources, and atmospheric deposition. Table 8 and 9 are key tools in this assessment; Table 8 shows the unit area (per acre) loads for each land use simulated in the Watershed Model for each of the model test segments, while Table 9 shows the 'percent of total load' derived from each source. These tables show only the mean values for the eight year simulation period, with the complete results provided in the Appendices.

Table 8 allows the model user to assess validity and reasonability of the unit area loading values by comparing them to 'expected' or generally accepted values, or ranges of values, from the literature. Table 9 allows the user to determine the relative distribution and contributions of each load source to each stream reach in the Watershed Model. Judicious and careful analysis of these two types of tables for each model segment allows the user to evaluate both the validity of the loading sources and identify those sources that may need to be re-evaluated in order to improve or refine the comparison between simulated and observed instream concentrations.

In this study, the nonpoint loading assessment involved two primary components. The first involved the evaluation and analysis of the AGCHEM results using the new yield-based plant uptake function. Uptake targets, nutrient application rates, and simulated plant uptake amounts for both N and P were reviewed and evaluated to ensure consistency and reasonability of the results. Uptake targets were derived from the expected uptake amounts for each crop and the cropping distributions within each model segment as described in the Phase II report (Donigian et al. 1994). The simulated plant uptake was then compared to the targets, by assessing the calculated deficits, and to the nutrient application rates for each segment to ensure that crop needs were being satisfied. Some adjustments were required to the new yield-based parameters (described in Chapter 2) to adjust the simulated uptake to the proper levels; the primary adjustments were to the uptake targets, the monthly distribution factors, and the soil layer fractions. Thus the plant uptake was the primary criteria for the AGCHEM parameter changes. The remaining AGCHEM parameters are essentially the same as those derived in the Phase II effort.

The second component involved a review and relative comparison of the nonpoint loading rates for all the land uses, and an assessment of the relative load contributions as derived from the information in Table 9. The key outcome of the loading rate comparison was the identification of the relatively high loading rates of $N0_3$ from the forest segment. In comparison with selected datasets for forested watershed sites, Hunsaker, Garten, and Mulholland (1994) noted that the $N0_3$ loading rates used in the Watershed Model were up to ten times greater in the Susquehanna than indicated by measured data, and up to five times greater in other model segments. The model values were in typically in the range of 1.0 to 6.0 lb/ac/year, whereas the measured data were in the range of 0.5 to 2.0 lb/ac/yr. Therefore in this effort we adjusted the forest segment parameters, primarily decreasing the subsurface $N0_3$ concentrations, to reduce the model generated forest loads to the general range of 1.0 to 2.0 lb/ac/yr.

Table 8. Unit Area Nonpoint Source Loading Rates for Each Land Use for the Test Model Segments

	CONSTITUENT	Pervious						Impervious		Total
		FOR	HTC	LTC	PAS	URB	HAY	ANML	URB	Load
SEGMENT 50	NH3	0.145	5.597	6.180	0.313	0.503	1.956	284.740	1.038	0.392
	NO3	2.188	15.799	18.687	7.641	10.265	16.798	71.185	2.161	3.811
	ORGN	0.182	1.015	0.697	0.580	1.726	0.282	1708.438	3.720	0.416
	TN	2.514	22.413	25.564	8.534	12.494	19.038	2491.472	6.920	4.639
	PO4	0.012	0.858	0.938	0.044	0.147	1.194	71.185	0.479	0.085
	ORGP	0.026	0.282	0.186	0.083	0.247	0.076	284.740	0.531	0.066
	TP	0.038	1.140	1.124	0.127	0.393	1.269	498.294	1.010	0.157
	BOD	4.894	32.333	16.613	15.645	46.525	9.840	4982.944	30.083	8.864
	SED	0.038	0.319	0.180	0.091	0.130	0.119	0.000	0.000	0.055
SEGMENT 60	NH3	0.126	4.111	4.259	0.285	0.451	1.184	234.852	1.229	0.362
	NO3	1.889	18.643	19.816	7.010	9.559	14.981	58.713	3.108	3.537
	ORGN	0.164	1.325	0.955	0.910	1.544	0.366	1409.115	3.627	0.384
	TN	2.178	24.076	25.031	8.205	11.554	16.533	2054.959	7.963	4.306
	PO4	0.010	0.760	0.847	0.040	0.134	0.725	58.713	0.630	0.084
	ORGP	0.023	0.368	0.255	0.130	0.221	0.098	234.852	0.518	0.065
	TP	0.033	1.127	1.102	0.170	0.354	0.823	410.992	1.148	0.156
	BOD	4.414	40.549	20.854	24.525	41.613	12.203	4109.917	29.329	7.864
	SED	0.039	0.421	0.247	0.123	0.146	0.151	0.000	0.000	0.062
SEGMENT 70	NH3	0.124	3.495	3.321	0.286	0.460	1.418	246.166	1.530	0.915
	NO3	1.850	15.113	15.317	7.368	10.058	14.581	61.541	3.313	6.098
	ORGN	0.195	2.578	2.003	0.627	1.489	0.731	1476.996	3.591	0.901
	TN	2.170	21.186	20.639	8.281	12.006	16.731	2153.952	8.433	7.958
	PO4	0.009	0.663	0.737	0.039	0.130	0.926	61.541	0.742	0.249
	ORGP	0.028	0.715	0.534	0.090	0.213	0.198	246.166	0.513	0.198
	TP	0.037	1.378	1.272	0.129	0.342	1.123	430.790	1.255	0.461
	BOD	5.264	36.323	18.146	16.913	40.125	12.439	4307.904	29.036	12.418
	SED	0.041	0.795	0.497	0.143	0.147	0.281	0.000	0.000	0.187
SEGMENT 190	NH3	0.055	3.930	3.679	0.079	0.321	0.644	219.611	1.041	0.531
	NO3	1.412	17.101	14.407	5.059	5.790	3.373	54.903	2.289	3.809
	ORGN	0.358	3.822	3.249	0.907	2.083	1.262	1317.666	3.289	1.531
	TN	1.825	24.854	21.336	6.045	8.194	5.278	1921.596	6.620	6.004
	PO4	0.025	2.371	2.114	0.043	0.270	0.965	54.903	0.465	0.349
	ORGP	0.051	1.063	0.870	0.130	0.298	0.348	219.611	0.470	0.284
	TP	0.076	3.434	2.984	0.173	0.568	1.312	384.319	0.935	0.678
	BOD	2.898	98.213	57.548	7.331	16.845	24.440	3843.192	26.599	14.399
	SED	0.071	1.067	0.739	0.199	0.162	0.451	0.000	0.000	0.205
SEGMENT 200	NH3	0.040	2.849	2.690	0.066	0.235	0.365	183.384	1.350	0.343
	NO3	1.103	12.777	10.813	4.219	4.675	2.704	45.846	2.471	2.908
	ORGN	0.233	2.440	1.735	0.738	1.473	0.763	1100.306	3.234	0.991
	TN	1.375	18.063	15.237	5.022	6.384	3.832	1604.613	7.055	4.331
	PO4	0.005	1.812	1.631	0.035	0.190	0.660	45.846	0.460	0.221
	ORGP	0.033	0.687	0.464	0.105	0.210	0.208	183.384	0.462	0.178
	TP	0.038	2.499	2.095	0.141	0.400	0.868	320.923	0.922	0.429
	BOD	1.881	56.805	27.004	5.967	11.914	21.694	3209.225	26.153	9.253
	SED	0.053	0.702	0.401	0.153	0.172	0.276	0.000	0.000	0.136
SEGMENT 210	NH3	0.054	2.039	1.769	0.087	0.244	0.353	222.020	1.389	0.713
	NO3	1.716	8.960	8.451	5.494	6.995	3.045	55.505	2.974	4.577
	ORGN	0.117	1.434	0.802	1.475	1.444	0.430	1665.151	3.097	1.295
	TN	1.888	12.434	11.022	7.056	8.682	3.827	1942.676	7.459	6.585
	PO4	0.005	1.014	0.926	0.047	0.184	0.511	55.505	0.645	0.393
	ORGP	0.017	0.397	0.214	0.211	0.206	0.116	333.030	0.442	0.261
	TP	0.022	1.411	1.140	0.258	0.390	0.627	388.535	1.087	0.654
	BOD	3.165	36.270	17.993	39.763	38.913	16.860	3885.352	25.043	18.798
	SED	0.013	0.434	0.197	0.157	0.140	0.162	0.000	0.000	0.127

Table 8. Unit Area Nonpoint Source Loading Rates for Each Land Use for the Test Model Segments (Continued)

	CONSTITUENT	Pervious						Impervious		Total
		FOR	HTC	LTC	PAS	URB	HAY	ANML	URB	Load
SEGMENT 750	NH3	0.056	2.421	2.044	0.096	0.278	0.392	241.333	1.403	0.812
	NO3	1.794	8.384	8.522	5.448	6.934	3.301	60.333	3.004	4.723
	ORGN	0.178	2.265	1.292	1.853	1.804	0.655	1809.997	3.128	1.431
	TN	2.028	13.071	11.860	7.396	9.015	4.348	2111.663	7.535	6.966
	PO4	0.008	1.107	1.019	0.056	0.230	0.580	60.333	0.652	0.446
	ORGP	0.025	0.628	0.345	0.265	0.258	0.178	362.000	0.447	0.299
	TP	0.033	1.735	1.363	0.321	0.488	0.757	422.333	1.099	0.745
	BOD	4.789	54.840	25.496	49.938	48.613	24.199	4223.327	25.298	25.394
	SED	0.026	0.680	0.314	0.200	0.184	0.241	0.000	0.000	0.200

Table 9. Percent of Total Load Contributed from Each Source for the Test Model Segments

	CONSTITUENT	<----------------Pervious					--------------------->	<----Impervious---->		Point Source	Total Load
		FOR	HTC	LTC	PAS	URB	HAY	ANML	URB		
SEGMENT 50	NH3	12.54	12.22	3.44	2.84	2.41	6.29	1.44	0.90	57.91	100.00
	NO3	45.23	8.22	2.48	16.52	11.73	12.87	0.09	0.45	2.43	100.00
	ORGN	32.12	4.52	0.79	10.73	16.87	1.85	17.65	6.59	8.90	100.00
	TN	38.19	8.57	2.50	13.56	10.49	10.73	2.21	1.05	12.69	100.00
	PO4	4.56	8.41	2.34	1.79	3.16	17.22	1.62	1.87	59.07	100.00
	ORGP	24.01	6.56	1.11	8.02	12.62	2.60	15.40	4.93	24.77	100.00
	TP	10.09	7.68	1.93	3.55	5.83	12.61	7.80	2.71	47.80	100.00
	BOD	39.66	6.59	0.86	13.26	20.84	2.96	2.36	2.44	11.02	100.00
	SED	55.58	11.78	1.70	13.90	10.55	6.48	0.00	0.00	0.00	100.00
SEGMENT 60	NH3	19.25	16.91	11.66	2.71	1.22	9.91	2.78	1.33	25.12	100.00
	NO3	43.39	11.52	8.15	10.02	3.88	18.85	0.10	0.51	3.59	100.00
	ORGN	31.36	6.82	3.27	10.84	5.22	3.84	20.87	4.92	12.84	100.00
	TN	39.22	11.66	8.06	9.19	3.67	16.29	2.86	1.02	8.05	100.00
	PO4	5.09	10.39	7.70	1.26	1.20	20.17	2.31	2.27	49.61	100.00
	ORGP	24.82	10.49	4.84	8.58	4.13	5.70	19.27	3.89	18.27	100.00
	TP	11.14	10.10	6.57	3.52	2.09	15.02	10.60	2.71	38.26	100.00
	BOD	45.29	11.19	3.83	15.65	7.54	6.86	3.26	2.13	4.26	100.00
	SED	53.50	15.37	6.01	10.41	3.50	11.22	0.00	0.00	0.00	100.00
SEGMENT 70	NH3	5.35	25.26	16.98	1.05	0.69	10.28	1.99	1.16	37.25	100.00
	NO3	17.92	24.59	17.64	6.10	3.41	23.80	0.11	0.57	5.87	100.00
	ORGN	11.52	25.54	14.04	3.16	3.07	7.26	16.34	3.74	15.32	100.00
	TN	15.05	24.69	17.02	4.91	2.91	19.56	2.80	1.03	12.01	100.00
	PO4	1.01	12.02	9.45	0.36	0.49	16.82	1.24	1.41	57.19	100.00
	ORGP	6.83	29.37	15.54	1.87	1.82	8.14	11.29	2.22	22.90	100.00
	TP	2.74	17.03	11.12	0.81	0.88	13.93	5.94	1.63	45.92	100.00
	BOD	24.43	28.33	10.02	6.71	6.51	9.73	3.75	2.38	8.10	100.00
	SED	13.64	44.79	19.81	4.10	1.73	15.91	0.00	0.00	0.00	100.00
SEGMENT 190	NH3	1.66	5.29	11.49	1.06	1.40	4.69	5.44	1.33	67.63	100.00
	NO3	17.98	9.70	18.95	28.42	10.62	10.36	0.57	1.23	2.16	100.00
	ORGN	10.66	5.06	9.99	11.91	8.93	9.06	32.14	4.13	8.11	100.00
	TN	12.34	7.48	14.90	18.04	7.98	8.61	10.65	1.89	18.11	100.00
	PO4	2.03	8.52	17.63	1.55	3.14	18.77	3.63	1.59	43.14	100.00
	ORGP	7.59	7.02	13.34	8.48	6.36	12.44	26.71	2.95	15.11	100.00
	TP	3.81	7.63	15.38	3.81	4.09	15.80	15.72	1.97	31.77	100.00
	BOD	9.07	13.69	18.62	10.13	7.60	18.48	9.87	3.52	9.02	100.00
	SED	17.08	11.46	18.42	21.19	5.64	26.23	0.00	0.00	0.00	100.00
SEGMENT 200	NH3	2.22	5.51	7.29	1.25	0.76	4.23	5.33	2.30	71.12	100.00
	NO3	25.22	9.06	9.02	35.38	8.09	10.14	0.47	1.50	1.10	100.00
	ORGN	7.25	6.65	7.11	13.30	4.72	8.87	40.75	7.04	4.30	100.00
	TN	16.86	7.74	8.18	23.77	5.82	8.49	9.97	2.58	16.60	100.00
	PO4	0.36	10.19	12.12	1.50	1.21	31.10	3.85	2.27	37.40	100.00
	ORGP	5.03	9.08	9.21	9.23	3.27	11.53	32.98	4.88	14.80	100.00
	TP	1.75	9.34	10.63	3.76	1.78	23.63	17.45	2.95	28.70	100.00
	BOD	6.06	13.22	8.81	11.11	3.95	18.79	12.28	5.88	19.90	100.00
	SED	9.40	18.09	15.46	23.00	3.92	30.12	0.00	0.00	0.00	100.00
SEGMENT 210	NH3	1.17	7.64	21.91	0.67	0.58	3.34	4.68	1.84	58.17	100.00
	NO3	11.98	10.86	33.84	13.75	5.41	9.33	0.38	1.27	13.16	100.00
	ORGN	2.71	5.75	10.63	12.22	3.70	4.36	37.54	4.39	18.67	100.00
	TN	8.11	9.27	27.15	10.86	4.13	7.21	8.14	1.97	23.14	100.00
	PO4	0.29	9.49	28.62	0.92	1.10	12.09	2.92	2.13	42.43	100.00
	ORGP	1.97	8.12	14.44	8.90	2.69	6.00	38.27	3.20	16.37	100.00
	TP	0.82	9.06	24.17	3.42	1.60	10.18	14.02	2.47	34.25	100.00
	BOD	5.21	10.38	17.01	23.49	7.11	12.19	6.25	2.53	15.82	100.00
	SED	3.85	21.90	32.76	16.33	4.50	20.64	0.00	0.00	0.00	100.00

Table 9. Percent of Total Load Contributed from Each Source for the Test Model Segments (Continued)

	CONSTITUENT	Pervious FOR	Pervious HTC	Pervious LTC	Pervious PAS	Pervious URB	Pervious HAY	Impervious ANML	Impervious URB	Point Source	Total Load
SEGMENT 750	NH3	1.54	12.98	36.22	1.06	0.86	5.31	4.53	2.58	34.93	100.00
	NO3	12.23	11.16	37.48	14.97	5.32	11.11	0.28	1.37	6.07	100.00
	ORGN	3.90	9.71	18.30	16.40	4.46	7.10	27.16	4.61	8.38	100.00
	TN	8.86	11.16	33.45	13.04	4.44	9.39	6.31	2.21	11.13	100.00
	PO4	0.57	15.62	47.50	1.63	1.87	20.67	2.98	3.16	6.01	100.00
	ORGP	2.86	13.84	25.12	12.04	3.27	9.90	27.92	3.38	1.16	100.00
	TP	1.47	14.92	38.75	5.70	2.42	16.47	12.72	3.25	4.31	100.00
	BOD	6.09	13.61	20.91	25.60	6.96	15.19	3.67	2.16	5.82	100.00
	SED	4.51	22.81	34.80	13.87	3.57	20.43	0.00	0.00	0.00	100.00

The only other adjustments were to NH_3 loads from pasture, which were generally quite low in Phase II, and BOD loads in selected segments, when the adjustments were indicated by the assessment of the instream water quality simulation. With these few exceptions, the NPS loading simulation was essentially the same as in Phase II.

Water Quality Calibration Results

Following the loading assessment, water quality calibration involved adjustment of selected instream parameters to improve the overall comparison between observed and simulated concentrations. As noted above, the simulation of benthic oxygen demand and benthic algae were activated in this effort as part of the water quality calibration. These processes provided additional mechanisms impacting the instream simulation. The primary focus of the calibration was on maintaining reasonable levels of phytoplankton and benthic algae, since no observed data was available, and adjusting the related parameters so that the nutrients, both organic and inorganic, followed the observed variation. Periods of no phytoplankton, noted in the Phase II simulations, were eliminated with changes to the temperature adjustment and nutrient limitation parameters, benthic algae levels were established and adjusted, and the settling parameters controlling the organics were calibrated.

Complete simulation results, in the form of eight-year timeseries plots of daily simulated concentrations and the sporadic observed data are provided in the Appendices; the results for the Shenandoah segments, West Branch Susquehanna segments, and Monocacy segments are included in Appendices A, B, and C, respectively. The extent and volume of the results precludes duplication as part of this discussion, so the reader should refer to the results in the appendices to better comprehend the results discussion below.

Shenandoah Model Results

Figures 7 through 11 show the simulated results and observed data for the inorganic nutrients (NO_3, NH_3, and PO_4) along with the Total N and Total P for the Shenandoah River at Millville, WV (model segment 200) as examples of the model results.

Based on the results for all three model subbasins, the following conclusions and recommendations are provided:

a. The overall results show a significant improvement from the Phase II effort with improved seasonal variation and tracking of the observed values. However, problems still remain for selected constituents, and further 'fine tuning' of the calibration is recommended along with more detailed investigations into the algal simulation.

b. The addition of a benthal oxygen demand significantly improved the DO simulation during low flow periods that were typically over estimated in the Phase II results. This was an early indicator of the potential importance of the benthal processes on the overall water quality simulation.

c. The NO_3 simulations show good agreement with the observed data, as shown in Figure 7 for the Shenandoah. The seasonal variation is well represented for most years, but occasional peaks are well above the observed data. This is typical of most of the simulation results, and may be due to the relatively large model segments and long stream reaches used in the Watershed Model. However, the observed data is relatively infrequent (about every two months) and one sample point exceeding 9.0 mg/l NO_3-N in the summer of 1986 indicates that much higher concentrations are possible.

d. Both the NH_3 and PO_4 simulations (Figures 8 and 9) are generally higher than the observed data points, but mostly in the overall range of the observed data. Both of these constituents are highly sensitive to the algal simulation (phytoplankton and benthic algae), for which no data was available for any of the test model segments. This is probably the greatest data need at this time; additional instream algal data would help to assess the validity of the phytoplankton (and benthic algae) simulation and its impact on the inorganic nutrient simulations.

   It should be noted that for the Shenandoah, the greatest fraction of the total loads for both NH_3 and PO_4 are derived from point sources. For NH_3, 67% to 70%, on the average is derived from point sources, and up to 80% in some years. For PO_4, the range is 30% to 43%, and up to 60% in some years. Thus, although the concentration peaks in Figures 8 and 9 are likely due to nonpoint sources, the point sources are major contributors to the total load.

e. The Total N and Total P results in Figures 10 and 11 demonstrate behavior similar to that noted above. The Total N results are quite good and track the observed data with reasonable accuracy, while the Total P results are somewhat high.

f. The organic components (not shown here, but included in the Appendices) follow this pattern i.e. the Organic N is similar to the observed while the Organic P is somewhat high, leading to the differences shown to the totals. In our simulations, 30% to 40% of the organics is derived from the animal waste model segment. Also, the organic loads from the non-AGCHEM segments are derived from the BOD simulation with the conversion to organic N and P based on algal stoichiometry as derived in Phase II. It is clear that the BOD-organics conversion factors could be adjusted to improve the organic P simulation without greatly deteriorating the organic N simulation. However, both the animal waste loading representation and the algal N/P ratios should be further investigated in a joint effort to improve the organic simulation.

West Branch Susquehanna and Monocacy Model Results

Many of the same issues noted in the Shenandoah simulations are also observed in the model results for the West Branch Susquehanna River site, at Lewisburg, PA. Figures 12 and 13 show the model simulations and observed data for Total N and Total P at this site; Appendix B includes complete results for the West Branch

Susquehanna River. It is interesting to note that the Susquehanna N results show a dip in the simulated curve in the late summer/early fall for a few years that appears to be due to loading reductions that are not observed in the data. The NO_3 curves in Appendix B show this more dramatically. This could be due to an underestimate of N application rates, since they appear to be somewhat lower in the Susquehanna model segments, or accelerated crop uptake leading to depletion by the end of the growing season. Further investigations are needed.

The Monocacy model results show significant deviations between observed and simulated values for most of the nutrient constituents, and further investigation and calibration is recommended. Using model parameters similar in value to those used on the other two test segments produced concentration peaks four to five times greater than observed. However, limited observed data for only 27 months in 1989-91 was available for calibration for the upper segment (No. 750) which was added as an additional segment in Phase III. Figures 14 and 15 show the Total N and Total P simulations for the Monocacy River at Bridgeport, MD, with complete results provided in Appendix C.

Some observations and recommendations are as follows:

a. Except for the inorganic nutrients, the Monocacy results are generally consistent with the level of agreement shown in the other test segments. Flow, sediment, water temperature, DO, BOD, TOC, Chl a, and benthic algae are all consistent with the other results, and show generally good agreement when observed data is available.

b. The organics show the same behavior as in the other watersheds i.e. organic N is within reasonable agreement the limited data and organic P is generally high. As noted above, further investigation into the organics and BOD loadings and simulations are needed.

c. Concentrations peaks for the inorganic nutrients are high in spite of the loads from the agricultural land uses being in the lower end of the expected range. Loadings from the other land uses are all reasonable, so the high peaks remain a mystery needing further analysis and calibration, hopefully with more data. It should be noted that 1993 data near the downstream site near Fredericks, MD showed a Total N exceeding 6.0 mg/l, based on monthly grab samples, so the peak concentrations shown in Figure 14, for the smaller upstream site are not unreasonable, especially for intensive agricultural areas.

d. It should be noted that Segment 750 is the smallest of the Above Fall Line segments, and many of the watershed characteristics and parameters were based on the entire Phase II Segment 210 which included the new Segment 750 in the upper reaches of the watershed. Watersheds of this size, with low flows often less than 10 cfs, require more detailed spatial information in order to represent their behavior. Future efforts should review the land use, slopes, agricultural practices, and applications rates for this small watershed to assess the accuracy of the model input values.

e. Some limited water quality observations at the downstream site, along with continuous sediment data was not available for this effort; they should be used for calibration in any future efforts on the Monocacy.

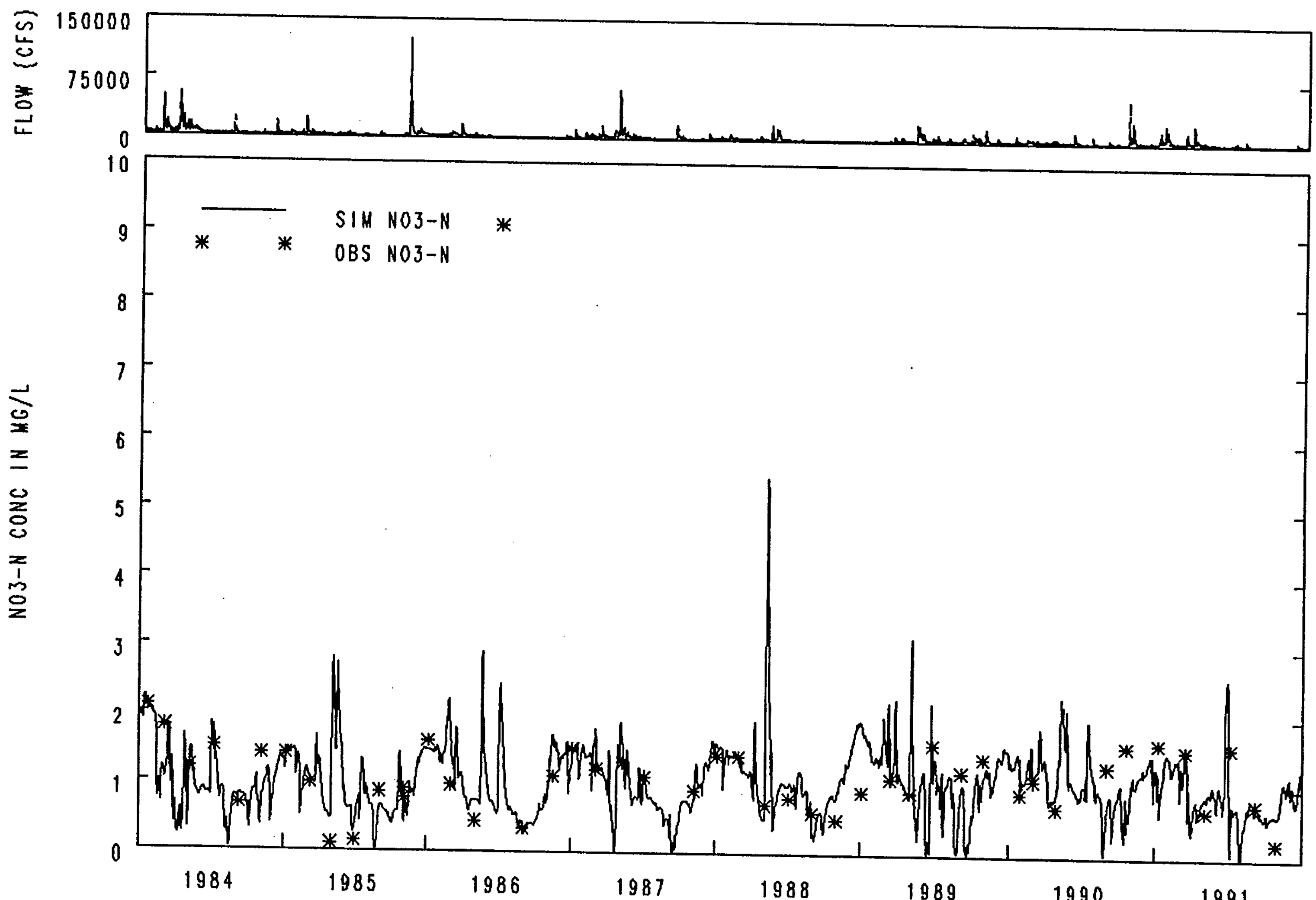


FIGURE 7. SIMULATED AND OBSERVED NO3-N FOR SHENANDOAH RIVER (SEGMENT 200) AT MILLVILLE, WV

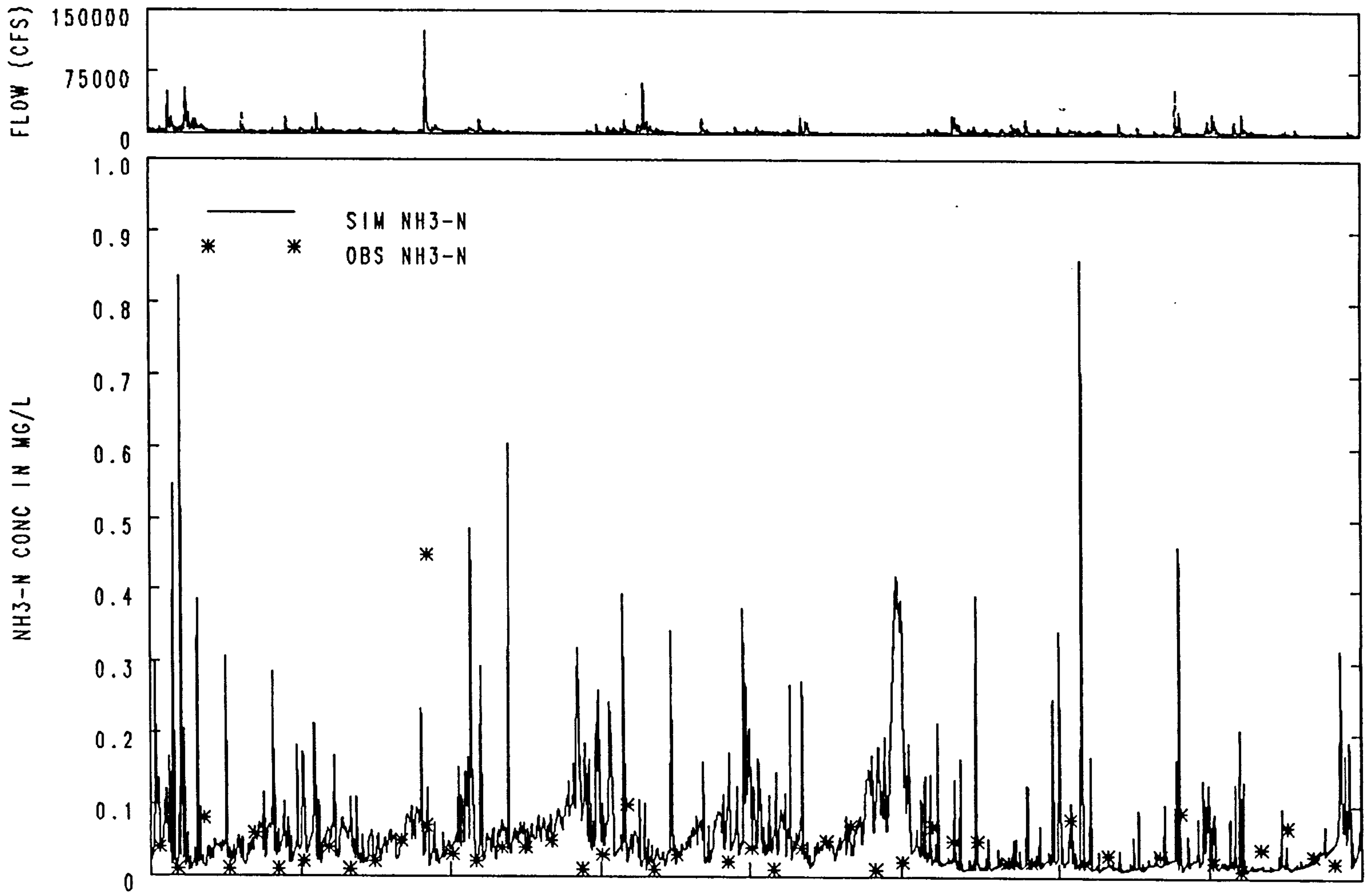


FIGURE 8. SIMULATED AND OBSERVED NH3-N FOR SHENANDOAH RIVER (SEGMENT 200) AT MILLVILLE, WV

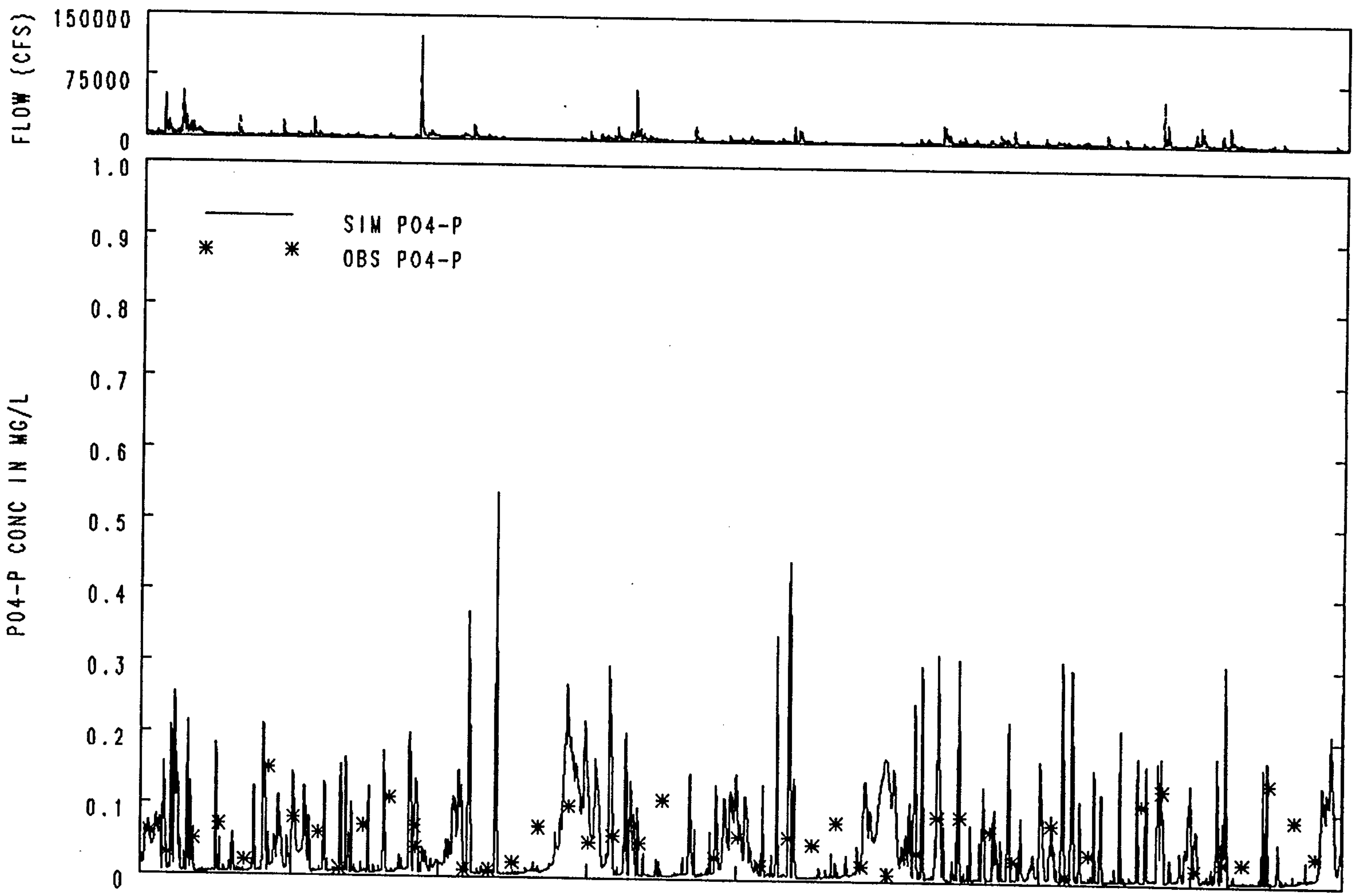


FIGURE 9. SIMULATED AND OBSERVED PO4-P FOR SHENANDOAH RIVER (SEGMENT 200) AT MILLVILLE, WV

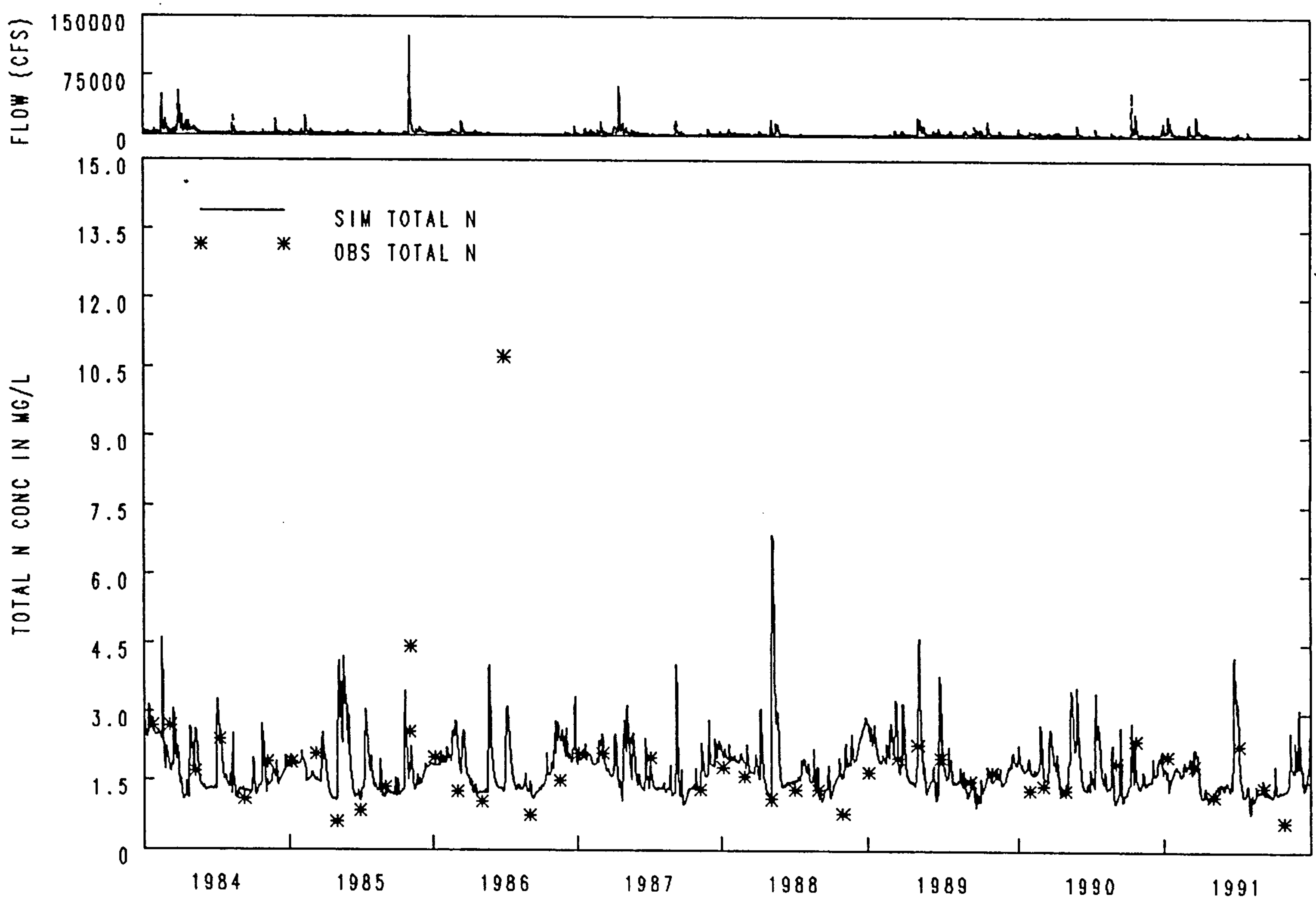


FIGURE 10. SIMULATED AND OBSERVED TOTAL N FOR SHENANDOAH RIVER (SEGMENT 200) AT MILLVILLE, WV

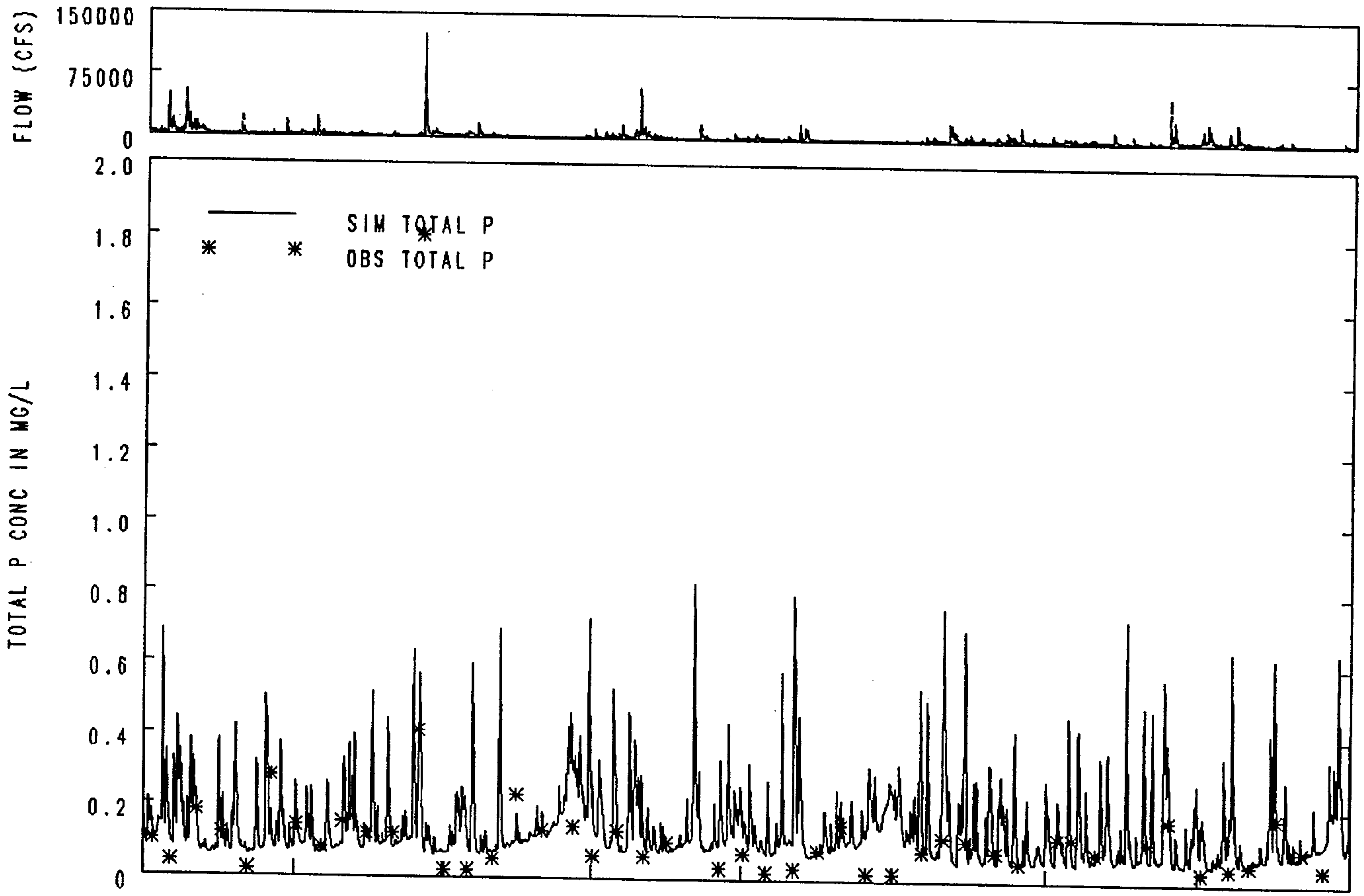


FIGURE 11. SIMULATED AND OBSERVED TOTAL P FOR SHENANDOAH RIVER (SEGMENT 200) AT MILLVILLE, WV

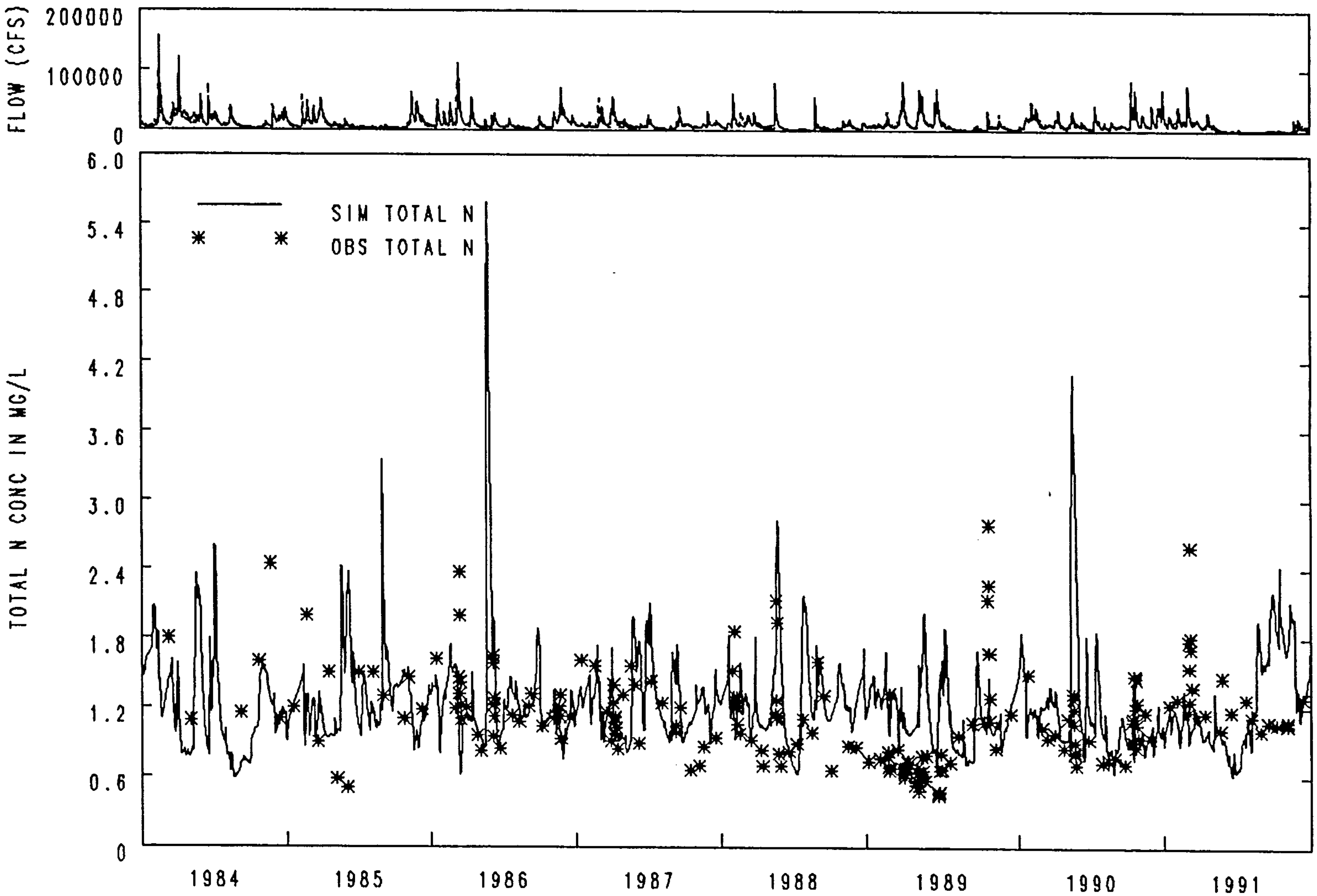


FIGURE 12. SIMULATED AND OBSERVED TOTAL N FOR WEST BRANCH SUSQUEHANNA RIVER (SEGMENT 70) AT LEWISBURG, PA

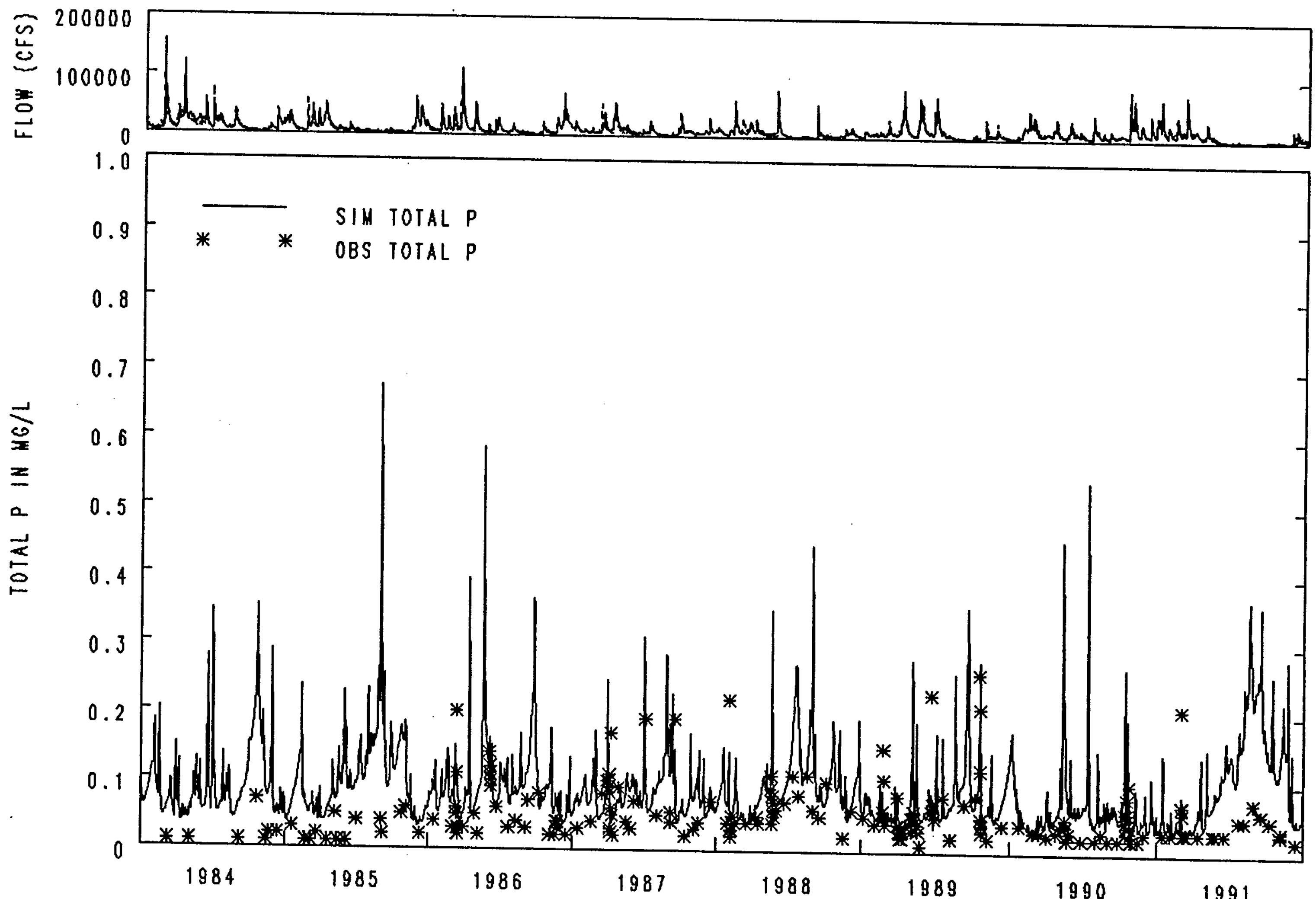


FIGURE 13. SIMULATED AND OBSERVED TOTAL P FOR WEST BRANCH SUSQUEHANNA RIVER (SEGMENT 70) AT LEWISBURG, PA

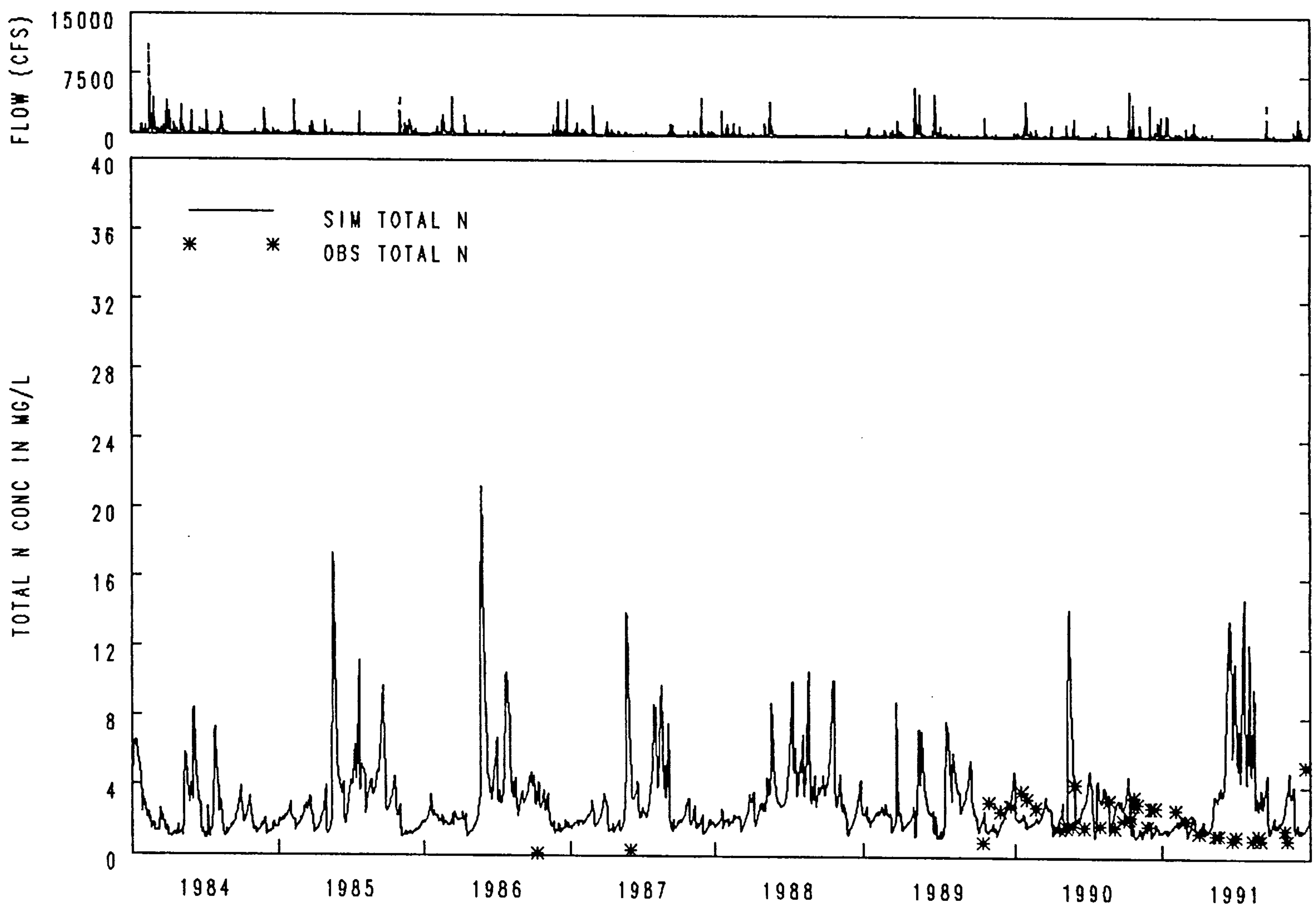


FIGURE 14. SIMULATED AND OBSERVED TOTAL N FOR MONOCACY RIVER (SEGMENT 750) AT BRIDGEPORT, MD

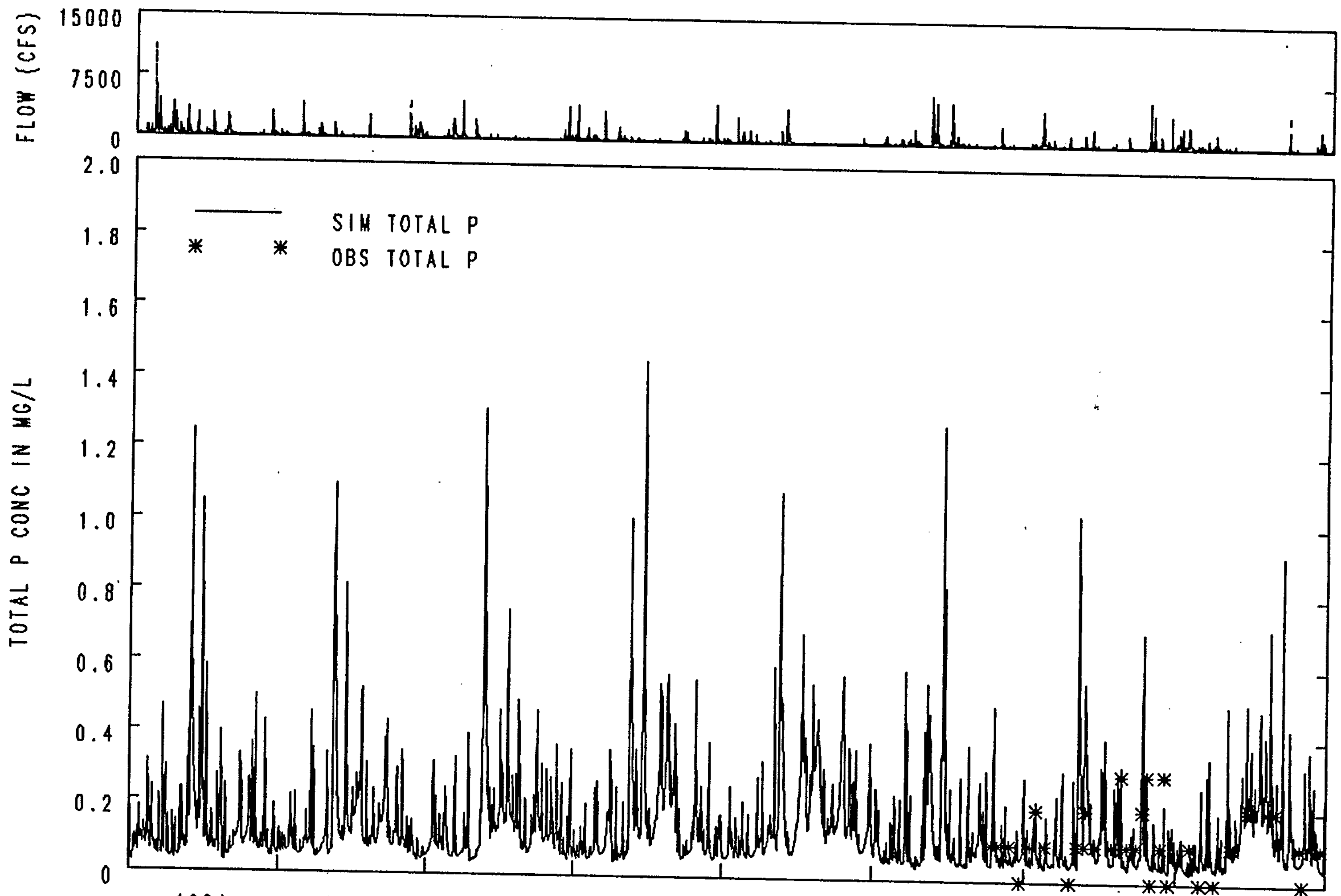


FIGURE 15. SIMULATED AND OBSERVED TOTAL P FOR MONOCACY RIVER (SEGMENT 750) AT BRIDGEPORT, MD

5 Representation of Nutrient Reduction Alternatives - A Demonstration

To demonstrate the use of the Watershed Model for evaluating the impacts of alternative nutrient reduction practices, selected scenarios were developed and simulated for the Shenandoah model segments. These alternatives were an outgrowth of the sensitivity runs performed with the AGCHEM module using the yield-based plant uptake algorithm described in Chapter 3. **These alternatives do not represent actual nor even recommended practices for the Shenandoah Basin; they are simply potential scenarios of model changes that are used to demonstrate and assess issues of concern in developing practices for evaluation.**

Alternative Scenarios

Two alternative scenarios were developed and compared to the Base Conditions which were represented by the calibrated conditions on the Shenandoah Basin. The alternatives were designed to represent a potential range of conditions that would likely be of interest. The changes implemented for each alternative were as follows:

Alternative #1:

1. All cropland is represented as Conservation Tillage (CST), i.e. all Conventional Tillage (CNT) land is converted to CST

2. No change in the amount of fertilizer applications on cropland or hay, but the timing was adjusted to better match the timing of crop needs

3. A 70% reduction in manure application was implemented on both CST and HAY

Alternative #2:

1. Same changes as in 1 above

2. A 40% reduction in fertilizer on CST and 10% reduction on Hay was implemented, along with the timing adjustments noted above

3. Mineralization rates were increased in the surface and upper soil layers to make more manure organics available for plant uptake

The current version of the AGCHEM model used in this effort includes only one Organic N and one Organic P compartment which represents the soil organic material. Thus, it was not originally designed for use with manure applications that include organics that mineralize at a faster rate that the parent soil material. To partially compensate for this limitation, the Phase II effort assumed that 30% of manure organic N was readily mineralizable and was applied as NH_3 at the time of application. However, the remaining organic N applied as manure continues to mineralize at the basic rate of the soil organic N. The same procedures were applied in this study.

Thus the two alternatives represent two opposite extremes. Alternative No. 1 reduces manure and maintains adequate plant available nutrients by applying fertilizer, while Alternative No. 2 reduces fertilizer (the preferred objective of nutrient management) and attempts to offset the loss of available nutrients by increasing the mineralization rate. The availability of the manure organics is an important issue if fertilizer reductions are to be offset by manure applications.

Results of Alternative Simulations

Tables 10 and 11 show the unit area impacts (i.e. lbs/ac) of the two alternatives as compared to the Base Conditions for both the Conservation Tillage and Hay model land use categories, respectively. These tables show the impacts on nutrient runoff losses, plant uptake, and the nutrient applications under each condition. A summary comparison is provided in Table 12, which shows the mean annual loads for the Base Condition and each alternative for the 1984 through 1991 simulation period for the inorganics and total nutrients for the Shenandoah River at Millville, WV.

For Conservation Tillage, the following observations are noted:

a. Alternative No. 1 clearly shows the greatest reduction in runoff losses even though it receives the lowest application rates and plant uptake is reduced. Since the fertilizer is applied in plant available form (i.e. inorganics), it is more readily taken up by the crop, making less available for runoff than under Alternative No. 2 and the Base Condition.

b. N uptake is reduced under Alternative No. 1 (by about 15%) but it is still in a reasonable range for expected yields for the composite crop. Out of the 131 lb/ac of inorganic N applied, 121 was taken up by the crop leading to a relatively high fertilizer efficiency. Note that other components of the N balance, such as mineralization, immobilization, denitrification, etc. are not shown here but are tabulated in the summary output tables in the appendices.

Table 10. Impacts of Alternatives for Conservation Tillage in the Upper Shenandoah Model Segment 190, 1984-87 (lb/ac)

	Base Conditions	Alternative No. 1	Alternative No. 2
Runoff Losses			
NO_3	12.25	7.37	12.41
NH_3	3.58	1.60	2.71
Org N	4.37	4.21	4.32
Total N	20.21	13.19	19.43
PO_4	1.93	0.70	1.29
Org P	1.17	1.12	1.17
Total P	3.10	1.83	2.46
Plant Uptake			
N	143.1	121.3	143.8
P	23.3	22.6	23.0
Nutrient Applications			
N	217.3	148.6	168.9
NO_3	30.1	29.8	17.9
NH_3	130.6	101.7	94.2
Org N	56.8	17.1	56.8
P	58.3	36.8	47.1
PO_4	43.0	32.2	31.8
Org P	15.3	4.6	15.3

Table 11. Impacts of Alternatives for Hay Cropland in the Upper Shenandoah Model Segment 190, 1984-87 (lb/ac)

	Base Conditions	Alternative No. 1	Alternative No. 2
Runoff Losses			
NO_3	3.40	3.22	3.24
NH_3	0.54	0.47	0.55
Org N	1.62	1.61	1.62
Total N	5:56	5.30	5.41
PO_4	0.90	0.83	0.83
Org P	0.45	0.44	0.44
Total P	1.35	1.27	1.27
Plant Uptake			
N	44.8	43.0	45.8
P	18.7	18.5	18.5
Nutrient Applications			
N	44.4	33.8	41.5
NO_3	7.3	7.3	6.6
NH_3	28.3	23.9	26.1
Org N	8.8	2.6	8.8
P	30.8	26.2	28.4
PO_4	27.5	25.2	25.1
Org P	3.3	1.0	3.3

Table 12. Nutrient Loadings Comparison for Base Conditions and Two Alternatives for the Shenandoah River at Millville, WV

MEAN ANNUAL LOADS FOR 1984 - 91

CONSTITUENT	BASELINE LBS	Alt. # 1 LBS	Alt. # 2 LBS	%CHANGE IN Alt. #1 FROM BASELINE	%CHANGE IN Alt. #2 FROM BASELINE
NH_3-N	13590	11541	14301	-15.1	5.2
NO_3-N	199841	143175	167093	-28.4	-16.4
TOTAL N	288678	238918	266100	-17.2	-7.8
PO_4-P	17995	12171	14342	-32.4	-20.3
TOTAL P	32025	27653	29992	-13.7	-6.4

c. Alternative No. 2 shows some reduction in runoff losses, and no significant change in plant uptake, due to added inorganic N available through the increased mineralization rates. This made more inorganic N available for both uptake and runoff. Note that the difference in the 143 lb/ac taken up by the plant the 112 lb/ac inorganic N applied is derived from the increased mineralization.

d. The impacts on P runoff are similar to those of N runoff, but the plant uptake of P is essentially the same for all three conditions. This results because more than enough PO_4 is applied to satisfy plant needs.

For the Hay cropland, similar observations are evident but the differences among the three conditions are not as dramatic due to the lower application rates and plant uptake levels. The plant uptake is essentially the same for all three conditions for both N and P, and the N runoff shows the same ordering as did the Conservation Tillage segment. P runoff and uptake show little or no difference among the alternatives, since the overall P balance is not greatly disturbed by the relatively small changes in the P applications.

The changes in total loads shown in Table 12 indicate that Alternative No. 1 leads to the greatest reduction in loads at the Shenandoah River watershed outlet, consistent with the unit area impacts noted above. Loads for all constituents are lower under Alternative No. 1 than for the Base Condition, while the loads under Alternative No. 2 are lower by a smaller amount (except for NH_3, discussed below).

Under Alternative No. 1, applications of Total N and Total P are reduced by about 30% and 37%, respectively, and these reductions lead to total load reductions of 17% and 14%, respectively. For Alternative No. 2, the application reductions are 22% and 19% for Total N and Total P, respectively, and the corresponding load reductions are 8% and 6 %. Thus, the impacts of application reductions are highly non-linear, due to the complications of the form of the nutrient being applied as compared to the crop demands.

It is interesting to note that Alternative No. 2 actually leads to a slight **increase** in the NH_3 load, as compared to the Base Condition. This is partially due to the increased NH_3 levels resulting from the increased mineralization (note that the Hay segment showed a slight increase in NH_3 runoff), but primarily due to the lower levels of phytoplankton (as shown by the Chl a plots in the appendices) and associated reduction in algal uptake of NH_3 . This further confirms the importance of the instream algal simulation in watershed assessment of nutrient management.

Conclusions and Issues for Nutrient Reduction

This demonstration of the simulation of alternative nutrient reduction scenarios has shown that the Watershed Model with the refined AGCHEM plant uptake routines provides a reasonable representation of nutrient balances at the watershed scale for evaluation of management options. Some of the conclusions and issues identified in this work are as follows:

a. The form, amount, and timing of nutrient (fertilizer and manure) applications are critical to reasonable modeling of watershed nutrient balances and the potential impacts of nutrient reduction alternatives.

b. The Watershed Model with the refined AGCHEM plant uptake routines developed in this work provides a viable framework for investigating these issues -- form, amount, timing of applications -- and their impacts on resulting water quality.

c. Because of the critical importance of these application issues, further efforts should be directed to more accurately defining these parameters for both the current (Base) application scenario and potential nutrient reduction alternatives of interest to the CBPO and it member states.

d. Since nutrient application is a direct function of crop needs, the CBPO should consider upgrading the Watershed Model to simulate the major crops individually and remove the 'composite crop' representation and its associated limitations. Further investigation of specific practices (e.g. split applications, cover crops, manure practices) and expected crop yields for individual model segments should be pursued as part of this effort.

e. If manure management and utilization is to be a significant component of the CBP nutrient reduction efforts, mineralization and subsequent availability of organic N from animal waste should be further investigated and the ability of the AGCHEM module to represent this component should be improved. Current efforts are underway to include multiple organic N compartments within AGCHEM to better model dissolved organic N (DON) from forested areas; these refinements may provide an opportunity to also address the issues related to plant availability of manure N.

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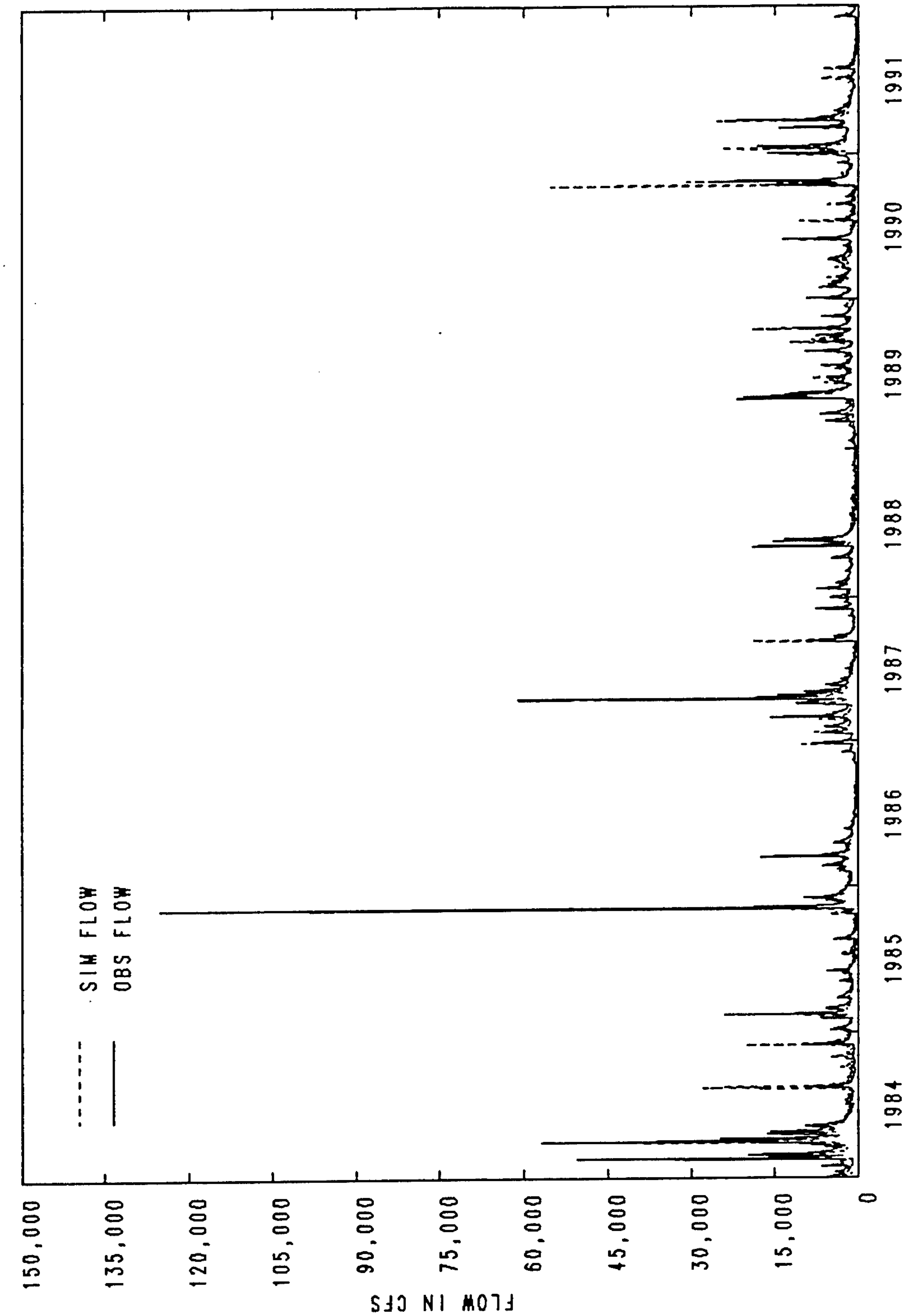
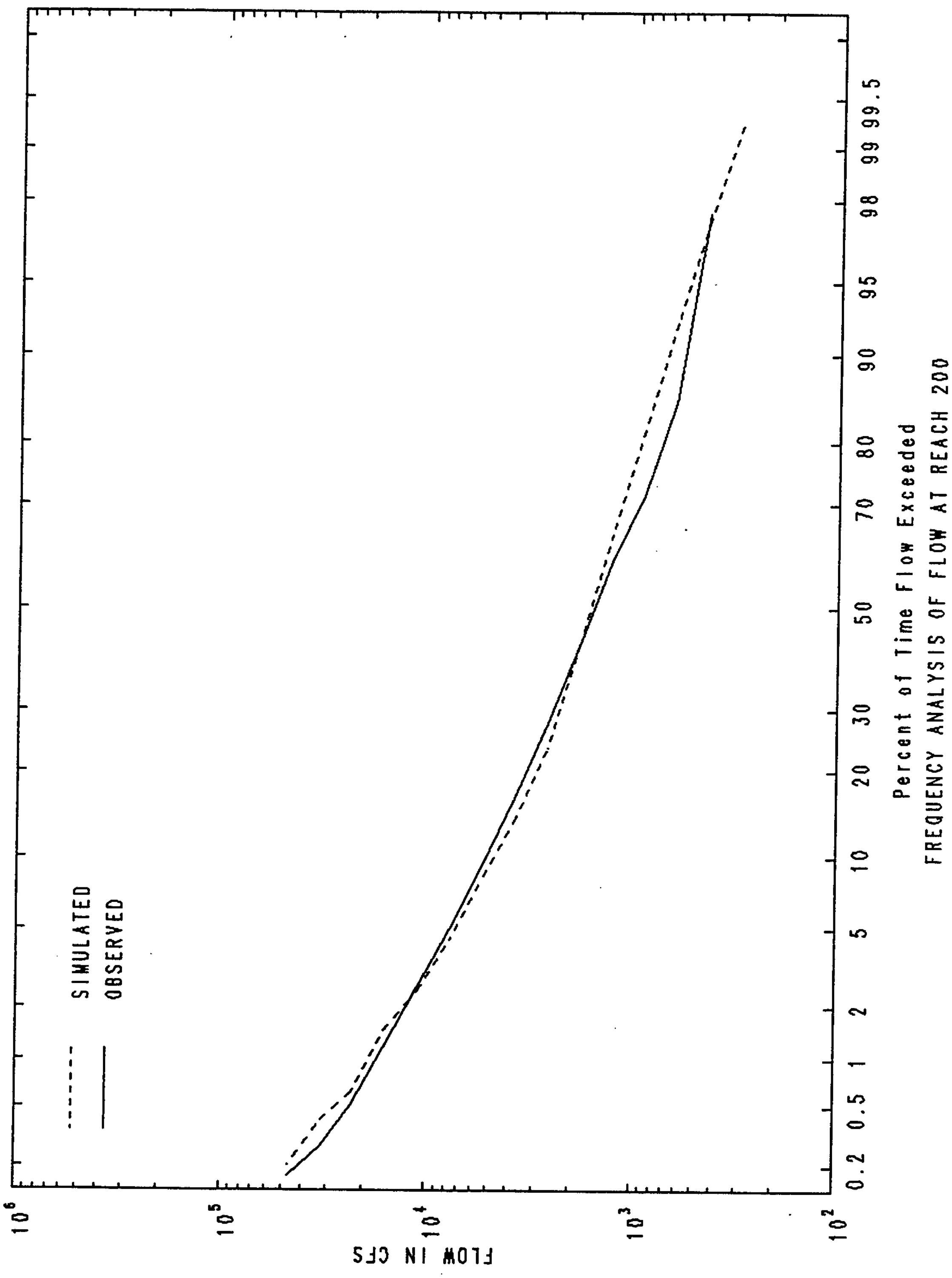
Appendices

Appendix A
Shenandoah Model Segments Results



SIMULATED AND OBSERVED FLOW AT REACH 200
SHENANDOAH RIVER AT MILLVILLE, WV


SIMULATED
OBSERVED
Percent of Time Flow Exceeded
FREQUENCY ANALYSIS OF FLOW AT REACH 200
SHENANDOAH RIVER AT MILLVILLE, WV
FLOW IN CFS
0.2
0.5
1
2
5
10
20
30
50
70
80
90
95
98
99
99.5
10^2
10^3
10^4
10^5
10^6

CHESAPEAKE BAY WATERSHED HYDROLOGIC CALIBRATION
COMPARISON OF ANNUAL TOTAL OBSERVED vs SIMULATED FLOW

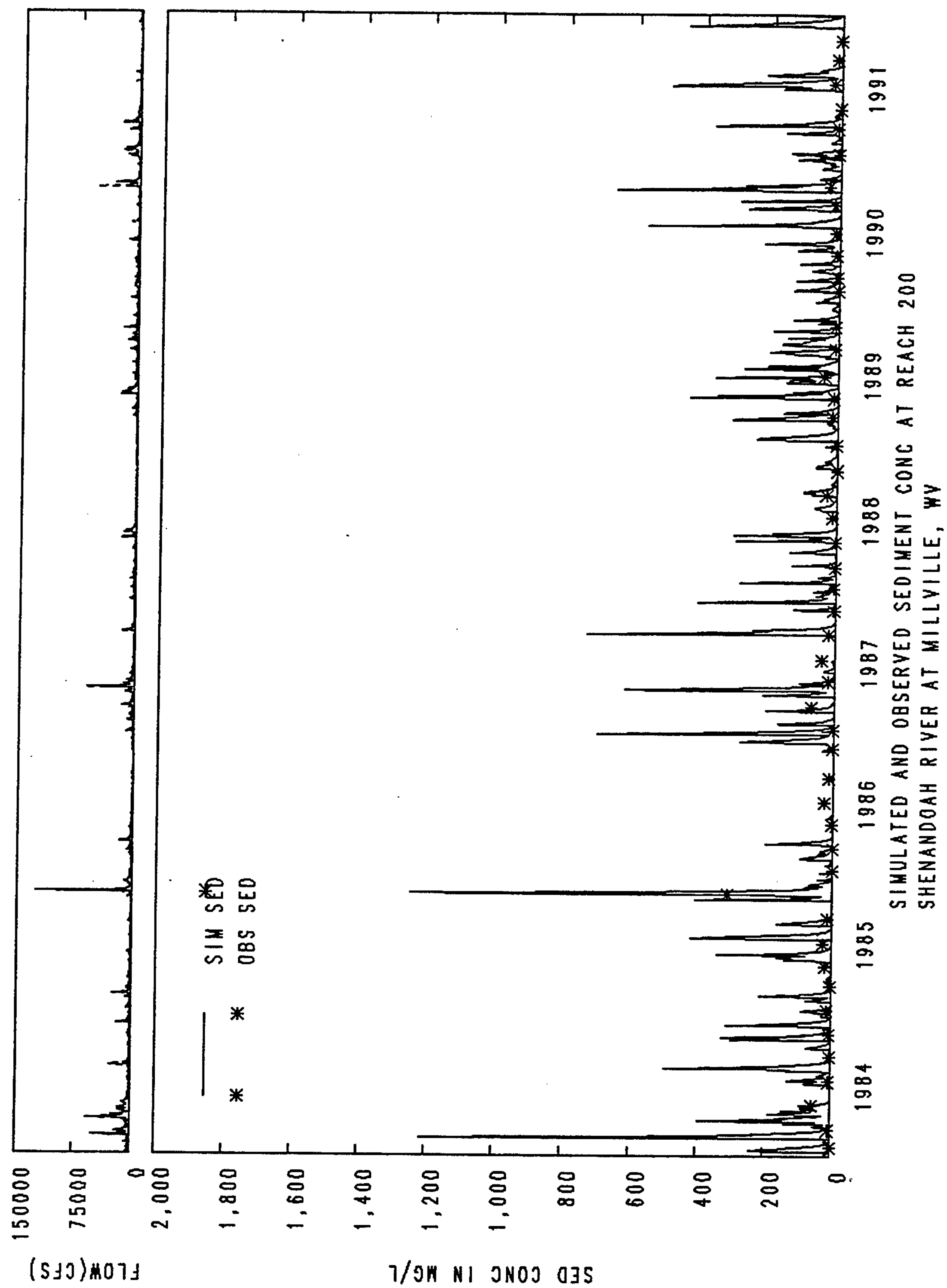
PHASE III

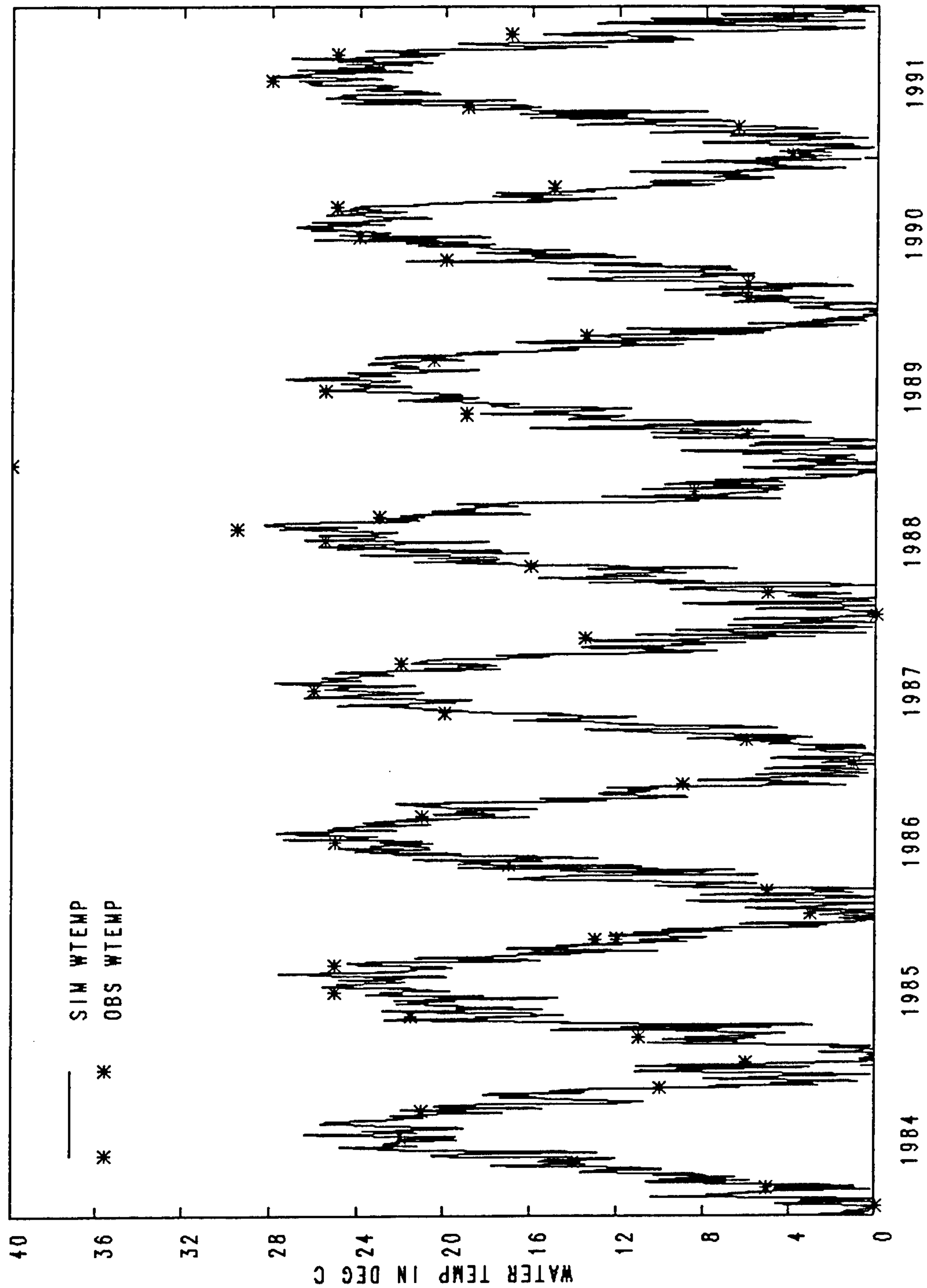
SHENANDOAH RIVER AT MILLVILLE, WV (SEGMENT 200)

YEAR	OBSERVED* FLOW (in)	SIMULATED** FLOW (in)
1984	17.86	17.53
1985	13.02	13.45
1986	6.93	6.49
1987	13.98	11.86
1988	7.74	6.76
1989	12.04	13.20
1990	11.60	13.78
1991	10.53	9.99
MEAN	11.71	11.63

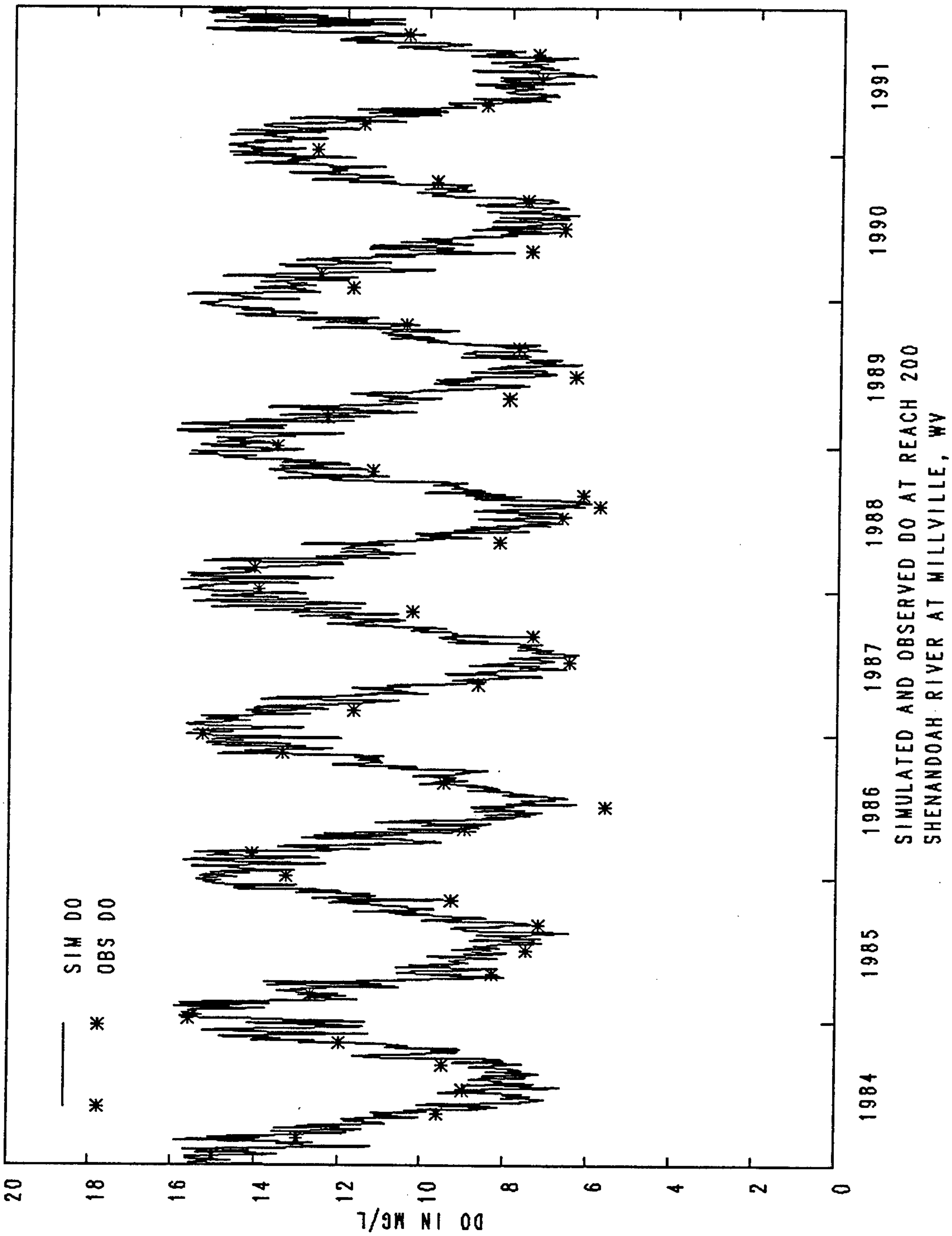
* - Observed Flow at Shenandoah River at Millville, WV

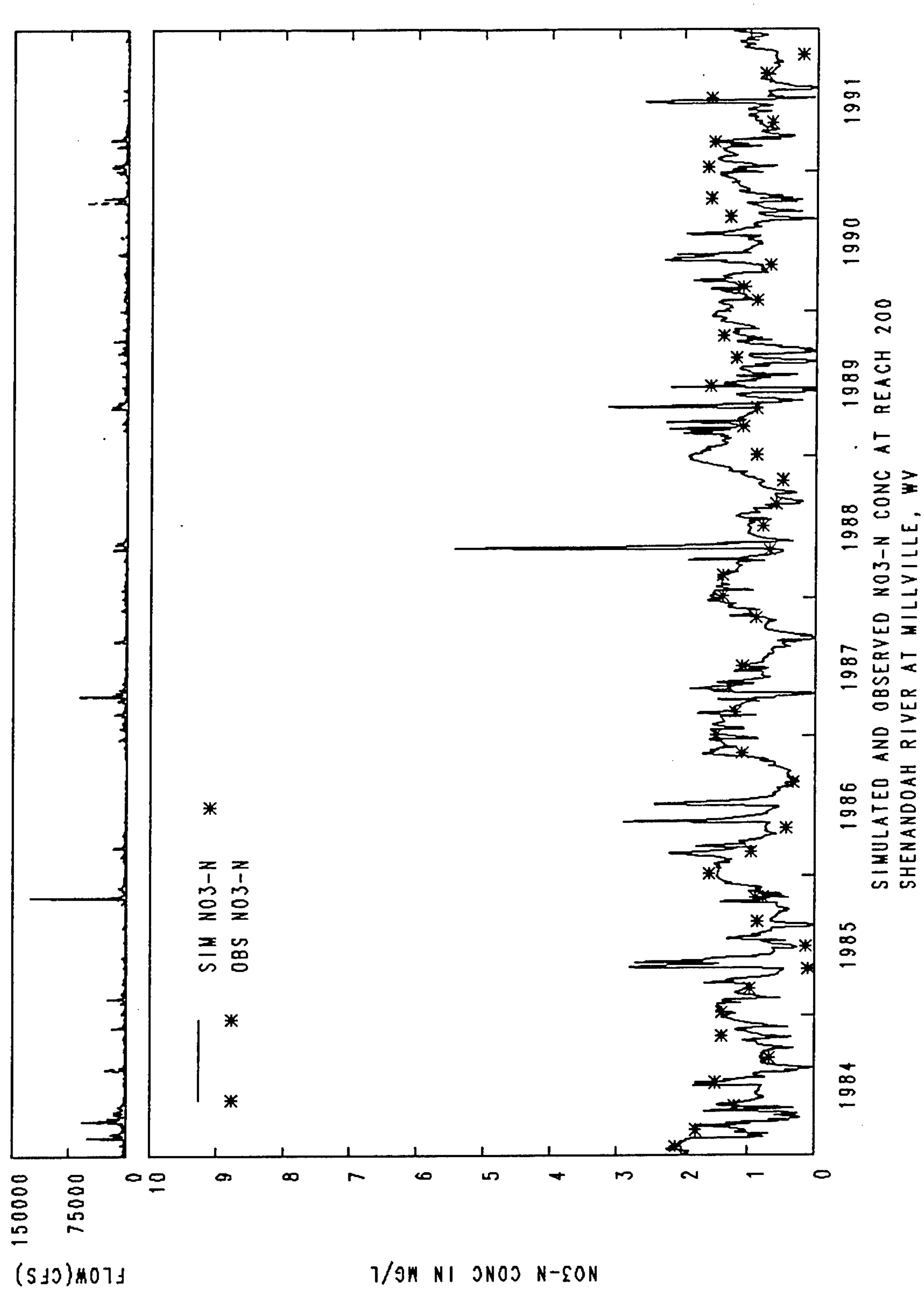
** - Simulated Outflow from RCH 200

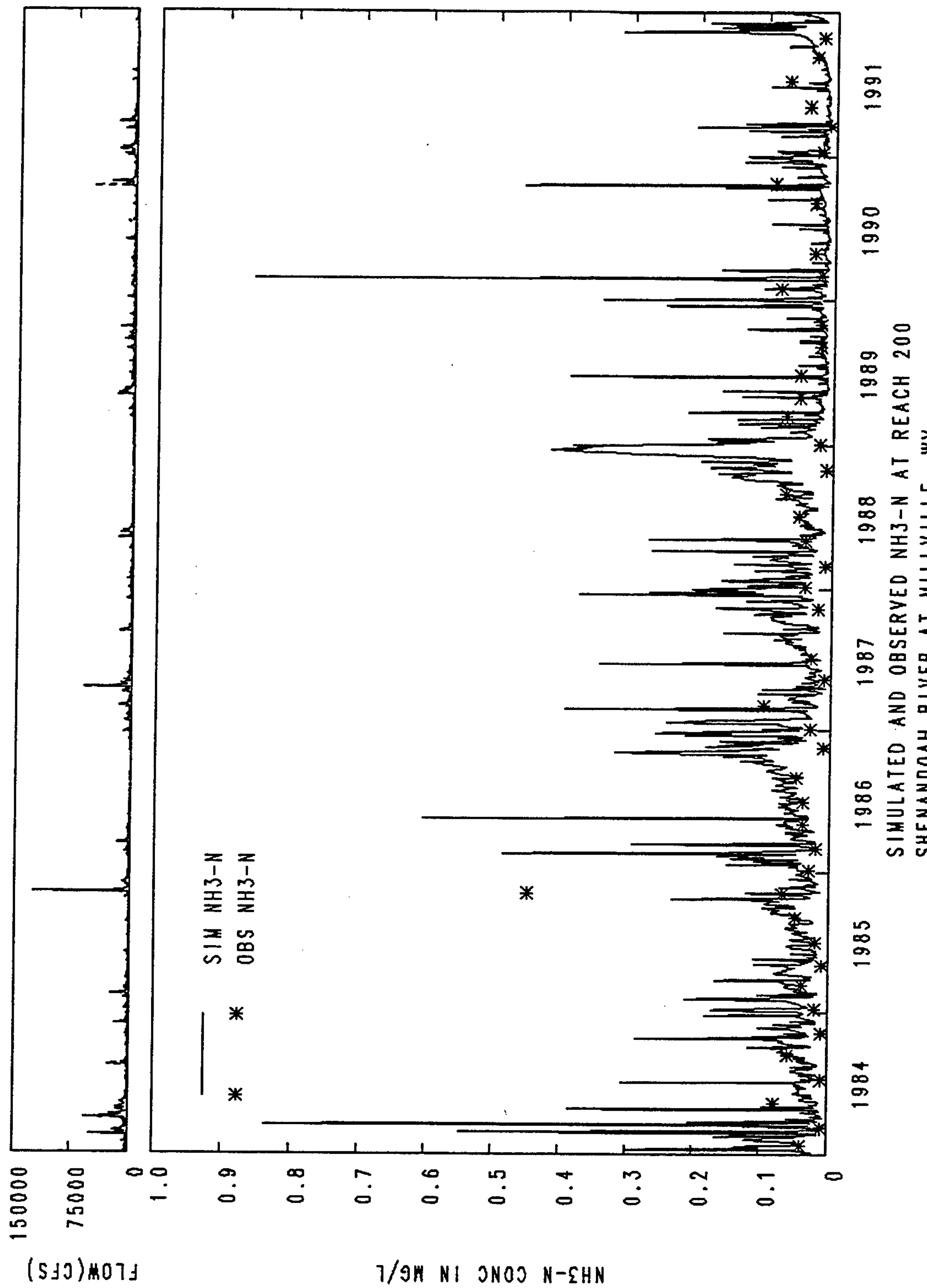

SIMULATED AND OBSERVED SEDIMENT CONC AT REACH 200
SHENANDOAH RIVER AT MILLVILLE, WV
SIM SED
OBS SED
FLOW(CFS)
SED CONC IN MG/L
150000
75000
0
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0.
1984
1985
1986
1987
1988
1989
1990
1991



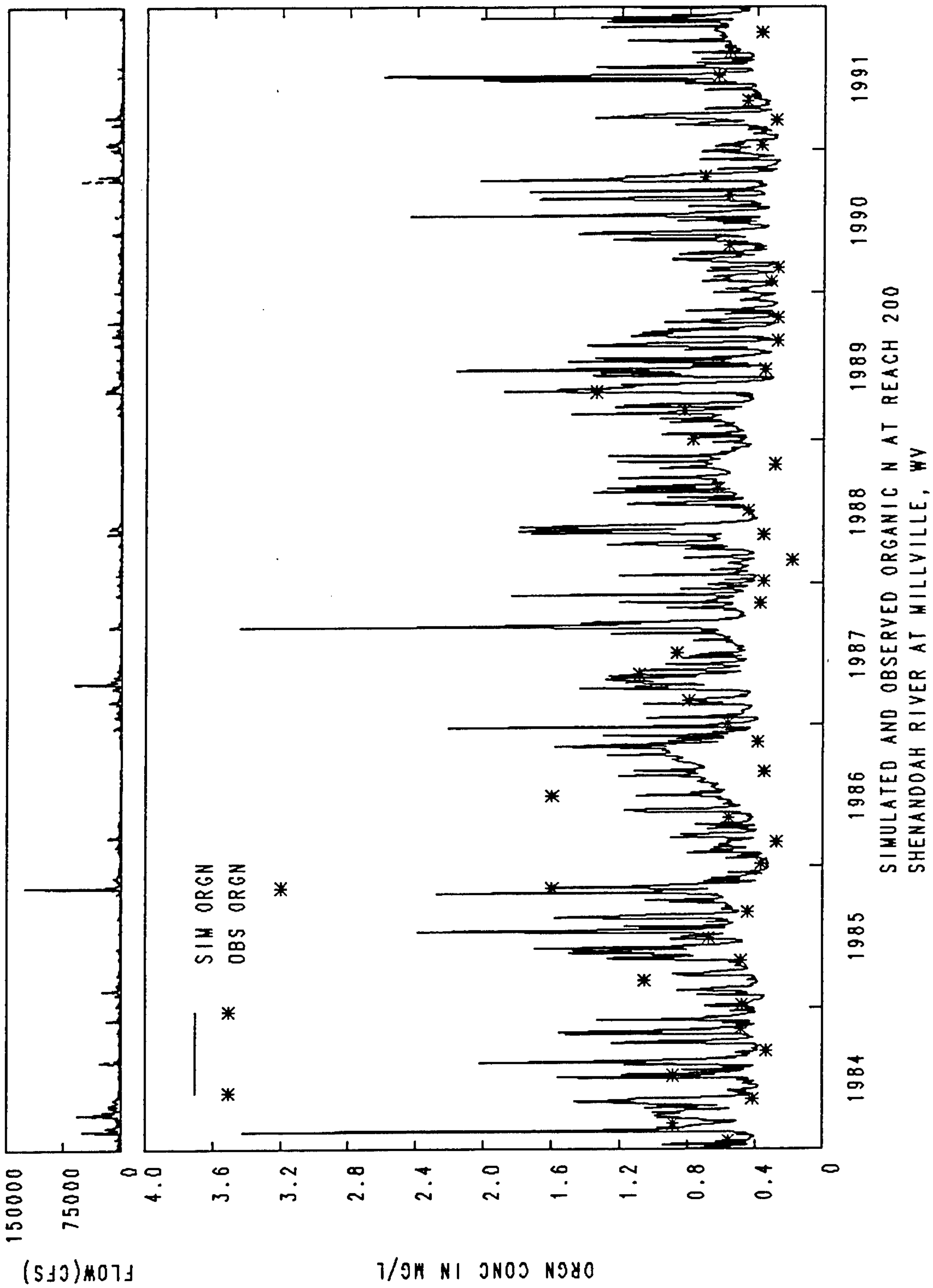
SIMULATED AND OBSERVED WATER TEMPERATUR AT REACH 200
SHENANDOAH RIVER AT MILLVILLE, WV

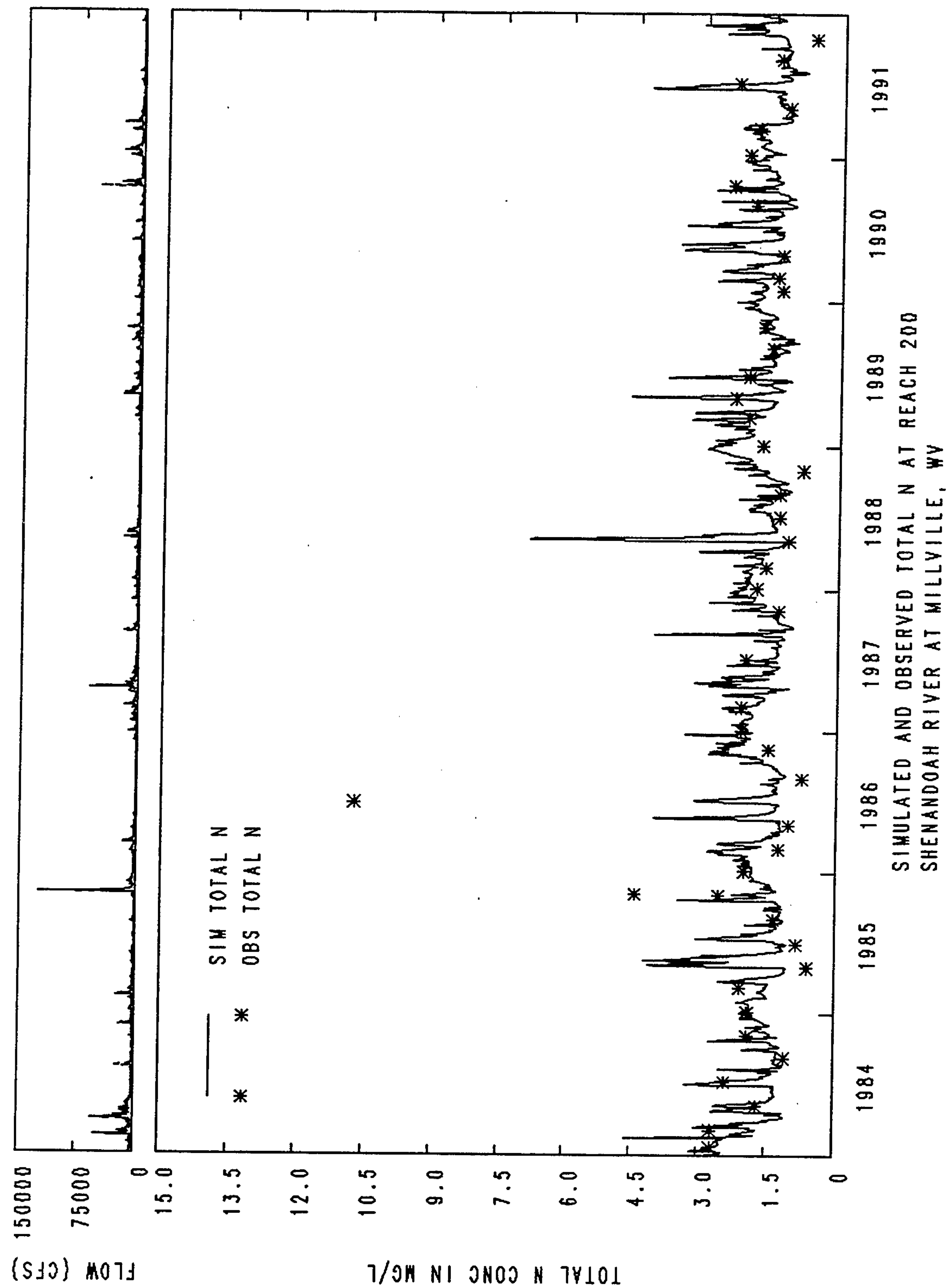

SIM DO
OBS DO
DO IN MG/L
0
2
4
6
8
10
12
14
16
18
20
1984
1985
1986
1987
1988
1989
1990
1991
SIMULATED AND OBSERVED DO AT REACH 200
SHENANDOAH RIVER AT MILLVILLE, WV

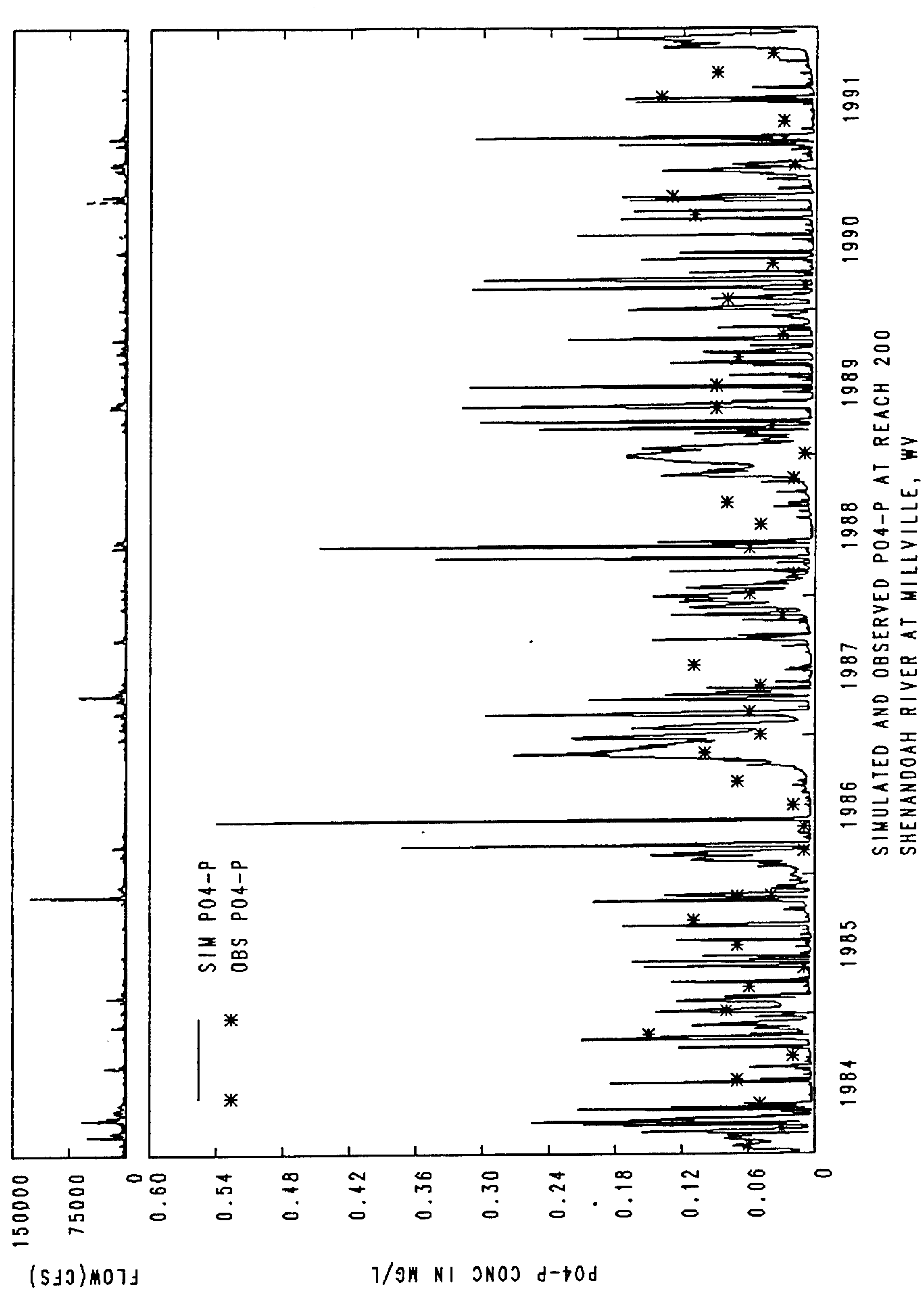

SIMULATED AND OBSERVED NO3-N CONC AT REACH 200
SHENANDOAH RIVER AT MILLVILLE, WV
SIM NO3-N
OBS NO3-N
FLOW(CFS)
NO3-N CONC IN MG/L
150000
75000
0
10
9
8
7
6
5
4
3
2
1
0
1984
1985
1986
1987
1988
1989
1990
1991

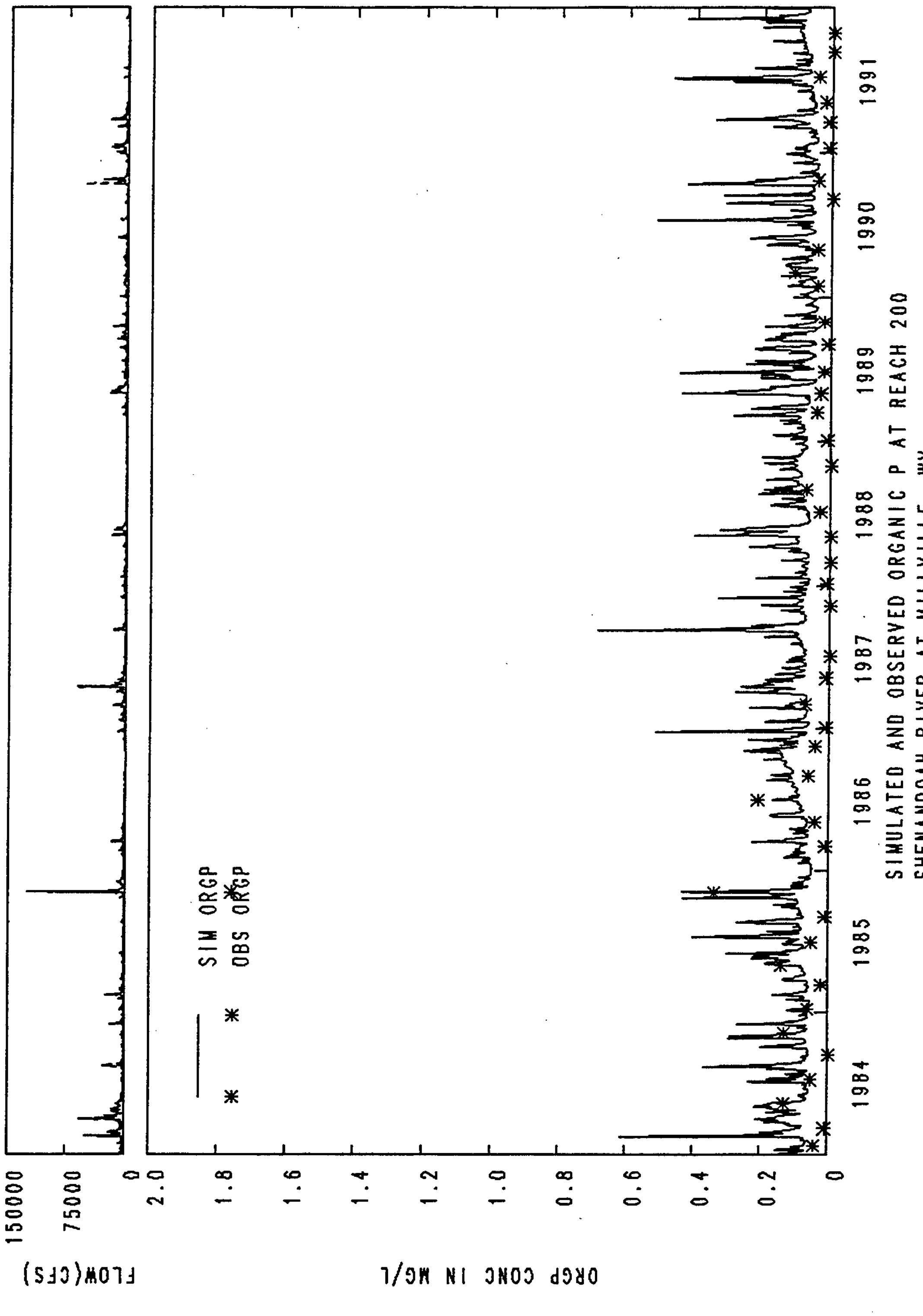


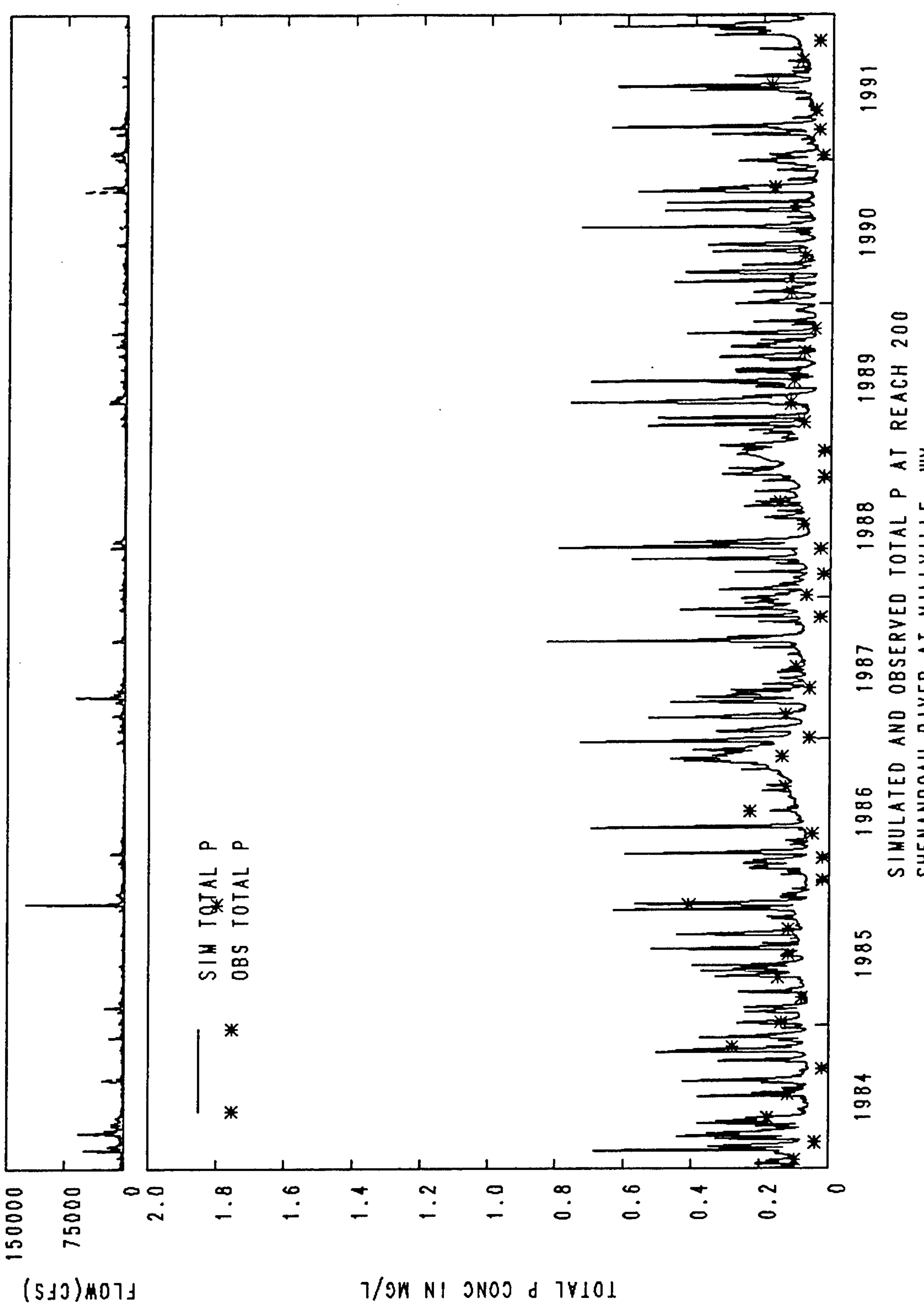
FLOW(CFS)
150000
75000
0
NH3-N CONC IN MG/L
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
SIM NH3-N
OBS NH3-N
1984
1985
1986
1987
1988
1989
1990
1991
SIMULATED AND OBSERVED NH3-N AT REACH 200
SHENANDOAH RIVER AT MILLVILLE, WV

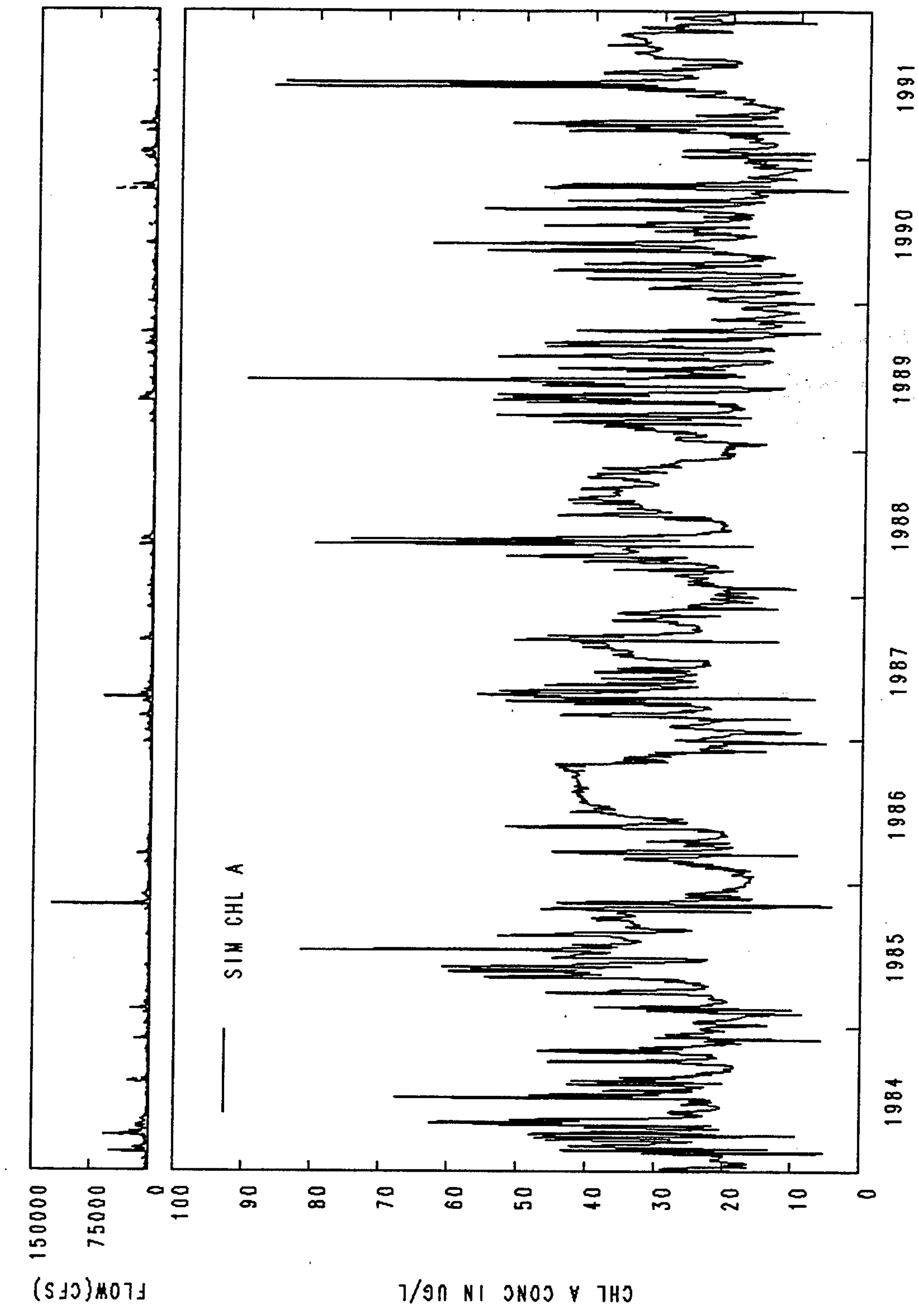

SIMULATED AND OBSERVED ORGANIC N AT REACH 200
SHENANDOAH RIVER AT MILLVILLE, WV
FLOW(CFS)
150000
75000
0
ORGN CONC IN MG/L
4.0
3.6
3.2
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0
SIM ORGN
OBS ORGN
1984
1985
1986
1987
1988
1989
1990
1991


FLOW (CFS)
150000
75000
0
TOTAL N CONC IN MG/L
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0
SIM TOTAL N
OBS TOTAL N
1984
1985
1986
1987
1988
1989
1990
1991
SIMULATED AND OBSERVED TOTAL N AT REACH 200
SHENANDOAH RIVER AT MILLVILLE, WV

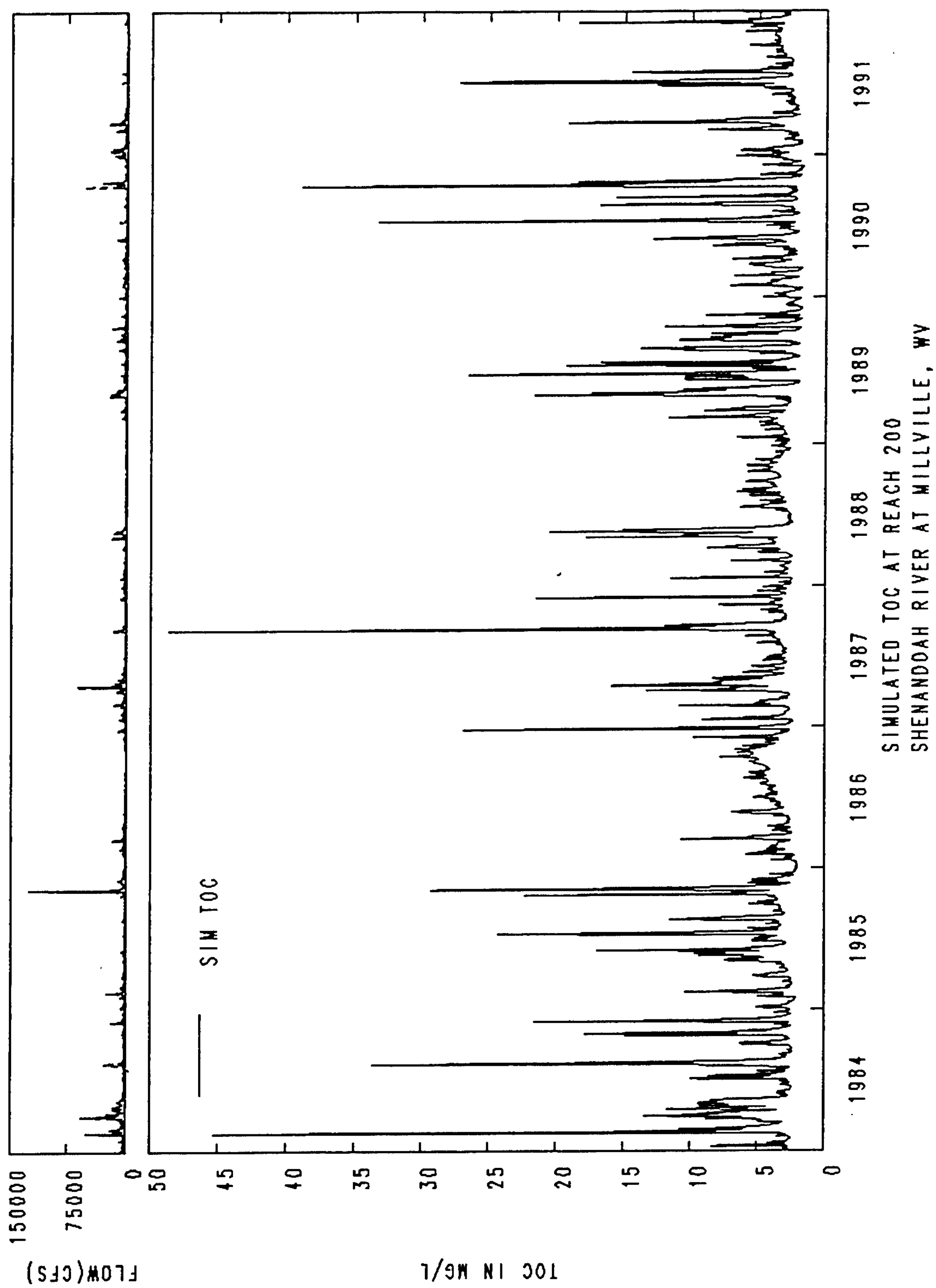

SIM PO4-P
OBS PO4-P
FLOW(CFS)
150000
75000
0
PO4-P CONC IN MG/L
0.60
0.54
0.48
0.42
0.36
0.30
0.24
0.18
0.12
0.06
0
1984
1985
1986
1987
1988
1989
1990
1991
SIMULATED AND OBSERVED PO4-P AT REACH 200
SHENANDOAH RIVER AT MILLVILLE, WV

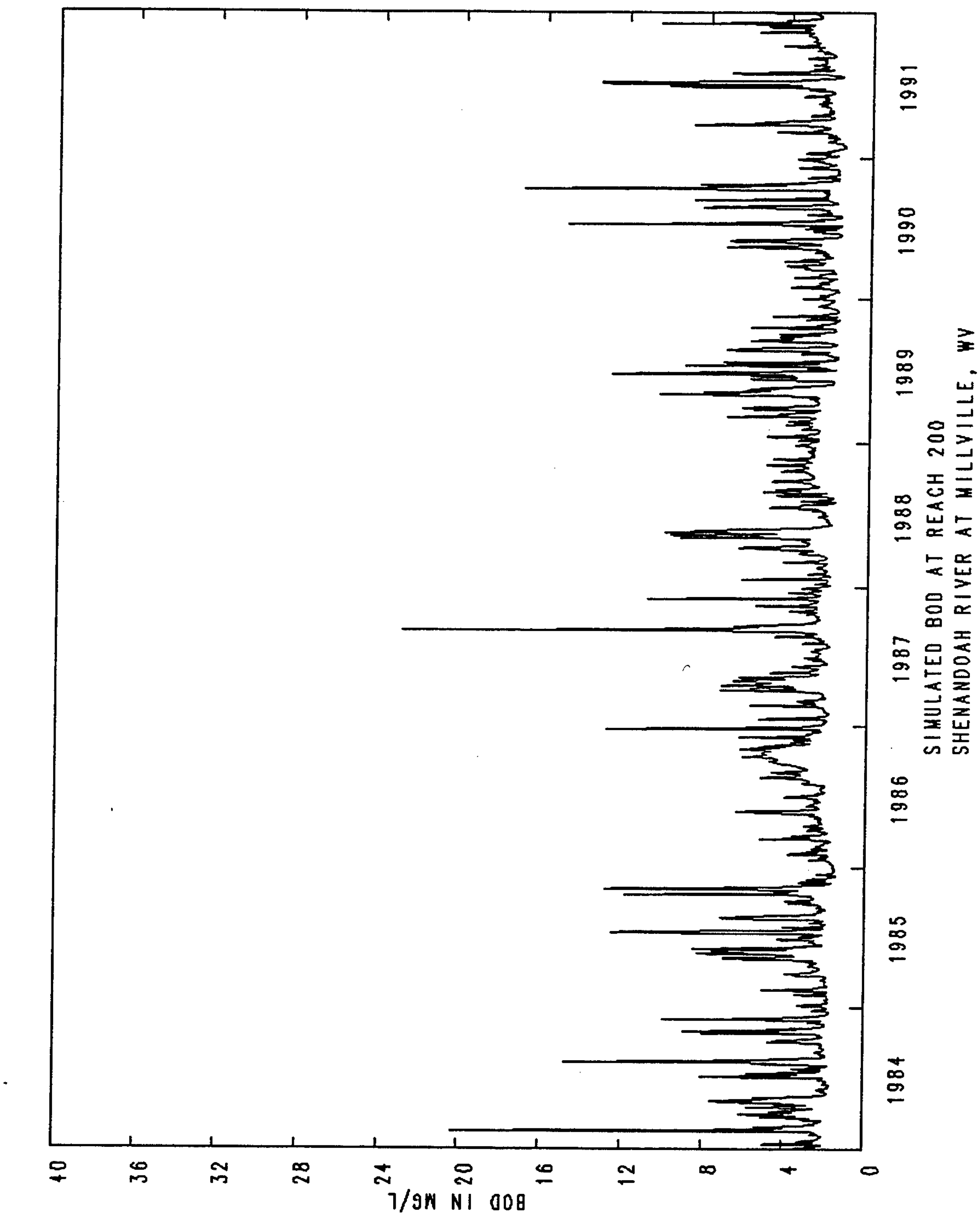

FLOW(CFS)
150000
75000
0
ORGP CONC IN MG/L
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
SIM ORGP
OBS ORGP
1984
1985
1986
1987
1988
1989
1990
1991
SIMULATED AND OBSERVED ORGANIC P AT REACH 200
SHENANDOAH RIVER AT MILLVILLE, WV

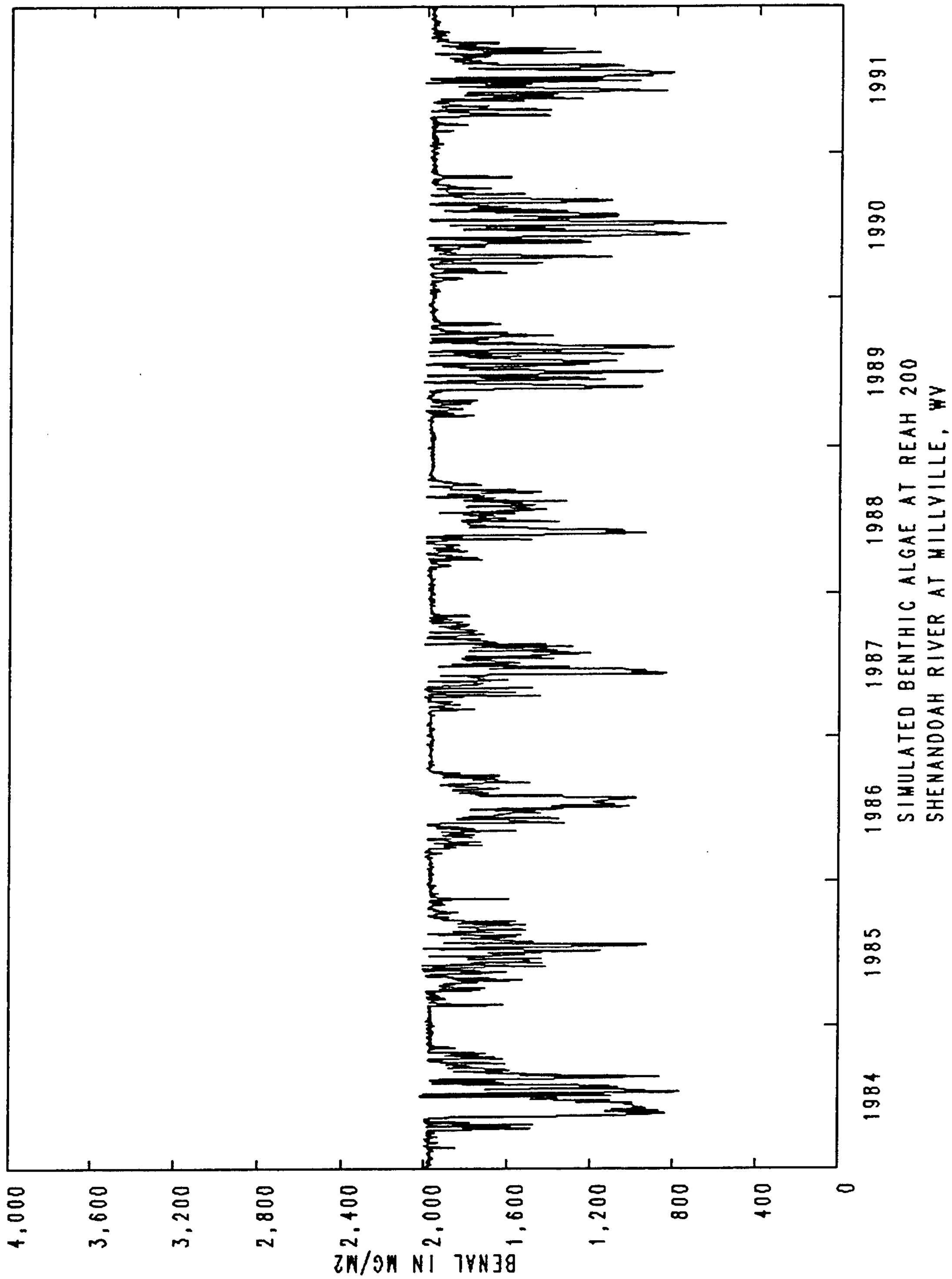

SIMULATED AND OBSERVED TOTAL P AT REACH 200
SHENANDOAH RIVER AT MILLVILLE, WV
SIM TOTAL P
OBS TOTAL P
FLOW(CFS)
TOTAL P CONC IN MG/L
150000
75000
0
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
1984
1985
1986
1987
1988
1989
1990
1991



SIMULATED CHLOROPHYLL A CONC AT REACH 200
SHENANDOAH RIVER AT MILLVILLE, WV


SIMULATED TOC AT REACH 200
SHENANDOAH RIVER AT MILLVILLE, WV
SIM TOC
FLOW(CFS)
150000
75000
0
TOC IN MG/L
50
45
40
35
30
25
20
15
10
5
0
1984
1985
1986
1987
1988
1989
1990
1991


SIMULATED BOD AT REACH 200
SHENANDOAH RIVER AT MILLVILLE, WV
BOD IN MG/L
0
4
8
12
16
20
24
28
32
36
40
1984
1985
1986
1987
1988
1989
1990
1991


SIMULATED BENTHIC ALGAE AT REAH 200
SHENANDOAH RIVER AT MILLVILLE, WV
BENAL IN MG/M2
4,000
3,600
3,200
2,800
2,400
2,000
1,600
1,200
800
400
0
1984
1985
1986
1987
1988
1989
1990
1991

AGCHEM RESULTS FOR SHENANDOAH (HI-TILL), SEGMENT 192

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	43.65	42.99	30.45	43.61	40.17
Runoff (in)					
Surface	11.89	9.687	2.636	8.933	8.286
Interflow	3.631	3.752	1.582	3.289	3.063
Baseflow	6.611	5.361	4.152	5.442	5.391
Total	22.13	18.80	8.369	17.66	16.74
Sediment Loss (t/a)	1.390	2.370	0.2770	1.560	1.399
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	1.181	0.4099	0.2172	0.4990	0.5768
Interflow	12.93	13.58	8.011	11.73	11.56
Baseflow	2.975	2.346	2.439	4.034	2.949
Total	17.09	16.33	10.67	16.27	15.09
NH3 Loss					
Surface	4.554	0.6716	0.8936	1.356	1.869
Interflow	1.353	1.781	1.518	2.262	1.729
Baseflow	0.3573E-01	0.9326E-02	0.3888E-02	0.3509E-02	0.1311E-01
Sediment	0.1642E-01	0.2475E-01	0.3416E-02	0.1687E-01	0.1536E-01
Total	5.959	2.487	2.419	3.638	3.626
ORGN Sediment	4.841	8.743	1.020	5.521	5.031
Total N Loss (lb/a)	27.89	27.56	14.11	25.43	23.75
PO4 Loss					
Surface	1.747	0.8882	0.8893	1.005	1.132
Interflow	0.5706	1.181	0.6109	1.360	0.9306
Baseflow	0.6270E-03	0.7579E-05	0.4806E-05	0.8252E-05	0.1619E-03
Sediment	0.7212E-01	0.1254	0.1830E-01	0.8645E-01	0.7557E-01
Total	2.391	2.195	1.519	2.451	2.139
ORGP Sediment	1.342	2.445	0.2823	1.534	1.401
Total P Loss (lb/a)	3.733	4.639	1.801	3.985	3.539
Atm Depn. NO3 (lb/a)	6.639	6.417	6.019	6.635	6.428
Atm Depn. NH4 (lb/a)	2.245	2.070	1.775	2.204	2.074
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	126.0	129.0	127.7	129.0	127.9
Nitrate appln.(lb/a)	28.48	29.46	29.05	29.46	29.11
ORGN appln.(lb/a)	56.76	56.76	56.76	56.76	56.76
Total N appln.(lb/a)	211.3	215.2	213.5	215.2	213.8
PO4-P appln.(lb/a)	42.60	44.39	43.65	44.39	43.76
ORGP appln.(lb/a)	15.30	15.30	15.30	15.30	15.30
Total P appln.(lb/a)	57.91	59.69	58.95	59.69	59.06
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.1000E-01	0.1600E-01	0.5000E-02	0.1000E-01	0.1025E-01
Upper	75.22	73.86	79.48	83.89	78.11
Lower	51.98	57.08	57.08	57.08	55.81
Total	127.2	131.0	136.6	141.0	133.9
Phosphorus					
Surface	0.8000E-02	0.1200E-01	0.3000E-02	0.8000E-02	0.7750E-02
Upper	19.58	19.92	19.93	19.91	19.83
Lower	3.753	3.752	3.752	3.752	3.752
Total	23.34	23.68	23.69	23.67	23.59
Deficit (lb/a)					
Nitrogen					
Surface	1.441	1.435	1.446	1.441	1.441
Upper	11.61	12.97	7.396	2.966	8.736
Lower	5.196	0.0000	0.0000	0.0000	1.299
Total	18.25	14.40	8.842	4.407	11.47
Phosphorus					
Surface	1.243	1.238	1.247	1.243	1.243
Upper	0.4419	0.9227E-01	0.9982E-01	0.1092	0.1858
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	1.685	1.330	1.347	1.352	1.428
Other Fluxes-lb/ac					
N Mineralization	18.66	21.40	22.05	22.06	21.04
P Mineralization	2.496	2.487	2.502	2.459	2.486
Denitrification	3.351	4.699	6.258	6.860	5.292
N Immobilization	22.95	26.50	26.73	26.17	25.59
P Immobilization	12.99	21.38	17.73	20.46	18.14

AGCHEM RESULTS FOR SHENANDOAH (HI-TILL), SEGMENT 192

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	31.42	45.43	41.84	35.51	38.55
Runoff (in)					
Surface	2.461	9.571	8.561	6.395	6.747
Interflow	1.588	3.969	3.331	2.128	2.754
Baseflow	4.360	6.394	5.551	4.896	5.300
Total	8.409	19.93	17.44	13.42	14.80
Sediment Loss (t/a)	0.1460	0.8070	1.120	0.8620	0.7337
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.2378	1.480	0.7108	0.6698	0.7746
Interflow	13.73	16.67	16.13	10.57	14.28
Baseflow	3.148	7.087	3.053	2.956	4.061
Total	17.12	25.24	19.89	14.20	19.11
NH3 Loss					
Surface	0.5165	4.789	2.844	1.706	2.464
Interflow	1.538	2.048	2.132	1.321	1.760
Baseflow	0.2033E-02	0.2348E-02	0.1589E-02	0.1610E-02	0.1895E-02
Sediment	0.1628E-02	0.1035E-01	0.1286E-01	0.1046E-01	0.8825E-02
Total	2.058	6.849	4.991	3.039	4.234
ORGN Sediment	0.4887	2.847	4.070	3.047	2.613
Total N Loss (lb/a)	19.67	34.94	28.95	20.28	25.96
PO4 Loss					
Surface	0.5708	1.969	2.148	0.9956	1.421
Interflow	1.135	1.630	1.107	0.6834	1.139
Baseflow	0.6205E-05	0.1546E-04	0.1031E-04	0.7217E-05	0.9798E-05
Sediment	0.8985E-02	0.4881E-01	0.6800E-01	0.5012E-01	0.4398E-01
Total	1.714	3.648	3.323	1.729	2.603
ORGP Sediment	0.1359	0.7911	1.129	0.8444	0.7251
Total P Loss (lb/a)	1.850	4.439	4.452	2.574	3.329
Atm Depn. NO3 (lb/a)	5.997	7.040	6.498	6.097	6.408
Atm Depn. NH4 (lb/a)	1.852	2.618	2.130	1.833	2.108
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	127.7	129.0	129.0	119.8	126.4
Nitrate appln.(lb/a)	29.05	29.46	29.46	26.41	28.60
ORGN appln.(lb/a)	56.76	56.76	56.76	56.76	56.76
Total N appln.(lb/a)	213.6	215.2	215.2	203.0	211.7
PO4-P appln.(lb/a)	44.39	44.39	44.39	44.39	44.39
ORGP appln.(lb/a)	15.30	15.30	15.30	15.30	15.30
Total P appln.(lb/a)	59.69	59.69	59.69	59.69	59.69
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.1100E-01	0.2300E-01	0.1500E-01	0.1100E-01	0.1500E-01
Upper	65.30	73.76	73.90	67.83	70.20
Lower	57.07	57.08	57.07	57.08	57.08
Total	122.4	130.9	131.0	124.9	127.3
Phosphorus					
Surface	0.9000E-02	0.2000E-01	0.1200E-01	0.8000E-02	0.1225E-01
Upper	19.91	19.90	19.93	19.43	19.79
Lower	3.753	3.752	3.752	3.752	3.752
Total	23.67	23.67	23.69	23.19	23.56
Deficit (lb/a)					
Nitrogen					
Surface	1.440	1.427	1.436	1.439	1.435
Upper	21.49	13.02	12.94	19.07	16.63
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	22.93	14.45	14.37	20.51	18.06
Phosphorus					
Surface	1.242	1.231	1.239	1.242	1.238
Upper	0.1181	0.1222	0.9433E-01	0.5848	0.2299
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	1.360	1.353	1.333	1.827	1.468
Other Fluxes-lb/ac					
N Mineralization	20.59	20.02	20.93	20.75	20.57
P Mineralization	2.486	2.492	2.522	2.472	2.493
Denitrification	7.727	10.45	5.672	5.684	7.383
N Immobilization	26.75	25.82	26.61	23.90	25.77
P Immobilization	21.02	23.55	19.64	20.02	21.06

AGCHEM RESULTS FOR SHENANDOAH (LOW-TILL), SEGMENT 193

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	43.65	42.99	30.45	43.61	40.17
Runoff (in)					
Surface	10.09	8.250	1.916	7.327	6.896
Interflow	3.565	3.726	1.503	3.193	2.997
Baseflow	7.245	5.996	4.483	5.937	5.915
Total	20.90	17.97	7.901	16.46	15.81
Sediment Loss (t/a)	1.010	1.720	0.1750	1.050	0.9887
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.9321	0.2866	0.1423	0.3981	0.4398
Interflow	11.54	12.14	6.482	9.989	10.04
Baseflow	2.574	1.558	1.123	1.853	1.777
Total	15.04	13.99	7.747	12.24	12.25
NH3 Loss					
Surface	5.337	0.5397	0.9575	1.178	2.003
Interflow	1.153	1.573	1.356	2.145	1.557
Baseflow	0.3701E-01	0.8887E-02	0.3359E-02	0.3275E-02	0.1313E-01
Sediment	0.1171E-01	0.1792E-01	0.2089E-02	0.1123E-01	0.1074E-01
Total	6.538	2.140	2.319	3.337	3.583
ORGN Sediment	4.326	7.789	0.7913	4.571	4.369
Total N Loss (lb/a)	25.91	23.92	10.86	20.15	20.21
PO4 Loss					
Surface	2.150	0.8366	0.9565	1.064	1.252
Interflow	0.5270	0.6874	0.3784	0.9238	0.6292
Baseflow	0.6368E-03	0.6012E-05	0.2165E-05	0.2519E-05	0.1619E-03
Sediment	0.5165E-01	0.9029E-01	0.1169E-01	0.5676E-01	0.5260E-01
Total	2.729	1.614	1.347	2.045	1.934
ORGP Sediment	1.154	2.097	0.2111	1.222	1.171
Total P Loss (lb/a)	3.883	3.711	1.558	3.267	3.105
Atm Depn. NO3 (lb/a)	6.639	6.417	6.019	6.635	6.428
Atm Depn. NH4 (lb/a)	2.245	2.070	1.775	2.204	2.074
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	128.4	131.7	130.4	131.7	130.6
Nitrate appln.(lb/a)	29.30	30.41	29.95	30.41	30.02
ORGN appln.(lb/a)	56.76	56.76	56.76	56.76	56.76
Total N appln.(lb/a)	214.5	218.9	217.1	218.9	217.3
PO4-P appln.(lb/a)	41.67	43.69	42.85	43.69	42.98
ORGP appln.(lb/a)	15.30	15.30	15.30	15.30	15.30
Total P appln.(lb/a)	56.97	58.99	58.15	58.99	58.28
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.2800E-01	0.2400E-01	0.7000E-02	0.2500E-01	0.2100E-01
Upper	80.37	81.97	88.71	91.98	85.76
Lower	51.25	61.12	61.13	55.95	57.36
Total	131.6	143.1	149.9	148.0	143.1
Phosphorus					
Surface	0.1900E-01	0.1800E-01	0.5000E-02	0.1900E-01	0.1525E-01
Upper	18.93	19.50	19.91	19.90	19.56
Lower	3.753	3.752	3.752	3.752	3.752
Total	22.70	23.27	23.67	23.67	23.33
Deficit (lb/a)					
Nitrogen					
Surface	1.523	1.526	1.544	1.526	1.530
Upper	12.49	11.07	4.300	0.9946	7.214
Lower	9.928	0.0000	0.0000	5.153	3.770
Total	23.94	12.60	5.844	7.673	12.51
Phosphorus					
Surface	1.232	1.233	1.246	1.232	1.236
Upper	1.085	0.5133	0.9982E-01	0.1092	0.4518
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	2.317	1.746	1.346	1.341	1.687
Other Fluxes-lb/ac					
N Mineralization	18.81	22.25	22.89	22.01	21.49
P Mineralization	2.765	2.714	2.759	2.744	2.746
Denitrification	2.505	2.969	2.725	3.018	2.804
N Immobilization	23.54	27.70	27.90	27.21	26.59
P Immobilization	15.33	23.14	19.00	21.78	19.81

AGCHEM RESULTS FOR SHENANDOAH (LOW-TILL), SEGMENT 193

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	31.42	45.43	41.84	35.51	38.55
Runoff (in)					
Surface	1.447	7.420	7.087	5.296	5.313
Interflow	1.479	3.951	3.365	2.152	2.737
Baseflow	4.788	7.142	6.262	5.450	5.911
Total	7.713	18.51	16.72	12.90	13.96
Sediment Loss (t/a)	0.7836E-01	0.5170	0.8060	0.5530	0.4886
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.1217	0.9763	0.5880	0.5449	0.5577
Interflow	12.28	16.56	16.22	9.944	13.75
Baseflow	1.888	4.546	1.147	1.435	2.254
Total	14.29	22.08	17.95	11.92	16.56
NH3 Loss					
Surface	0.4598	3.536	3.167	1.424	2.147
Interflow	1.502	1.689	2.016	1.275	1.620
Baseflow	0.2005E-02	0.2276E-02	0.1532E-02	0.1601E-02	0.1854E-02
Sediment	0.8305E-03	0.6175E-02	0.9018E-02	0.6571E-02	0.5649E-02
Total	1.965	5.234	5.194	2.707	3.775
ORGN Sediment	0.3173	2.225	3.557	2.413	2.128
Total N Loss (lb/a)	16.57	29.54	26.70	17.04	22.46
PO4 Loss					
Surface	0.5983	1.787	2.123	1.064	1.393
Interflow	0.9134	1.353	0.7625	0.4613	0.8725
Baseflow	0.1696E-05	0.3243E-05	0.1221E-05	0.8632E-06	0.1756E-05
Sediment	0.4732E-02	0.3056E-01	0.4681E-01	0.3270E-01	0.2870E-01
Total	1.516	3.171	2.932	1.558	2.294
ORGP Sediment	0.8493E-01	0.5962	0.9516	0.6442	0.5692
Total P Loss (lb/a)	1.601	3.767	3.884	2.202	2.864
Atm Depn. NO3 (lb/a)	5.997	7.040	6.498	6.097	6.408
Atm Depn. NH4 (lb/a)	1.852	2.618	2.130	1.833	2.108
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	130.4	131.7	131.7	121.4	128.8
Nitrate appln.(lb/a)	29.95	30.41	30.41	26.95	29.43
ORGN appln.(lb/a)	56.76	56.76	56.76	56.76	56.76
Total N appln.(lb/a)	217.1	218.9	218.9	205.1	215.0
PO4-P appln.(lb/a)	43.69	43.69	43.69	43.69	43.69
ORGP appln.(lb/a)	15.30	15.30	15.30	15.30	15.30
Total P appln.(lb/a)	58.99	58.99	58.99	58.99	58.99
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.1800E-01	0.4400E-01	0.2000E-01	0.2200E-01	0.2600E-01
Upper	76.91	78.35	80.72	75.78	77.94
Lower	61.11	59.64	57.65	53.09	57.87
Total	138.0	138.0	138.4	128.9	135.8
Phosphorus					
Surface	0.1300E-01	0.3500E-01	0.1500E-01	0.1600E-01	0.1975E-01
Upper	19.91	18.53	19.93	19.27	19.41
Lower	3.753	3.752	2.902	2.062	3.117
Total	23.68	22.32	22.84	21.35	22.55
Deficit (lb/a)					
Nitrogen					
Surface	1.533	1.507	1.531	1.528	1.525
Upper	15.92	14.45	12.19	17.12	14.92
Lower	0.0000	1.441	3.452	8.015	3.227
Total	17.46	17.40	17.17	26.66	19.67
Phosphorus					
Surface	1.238	1.215	1.236	1.235	1.231
Upper	0.1181	1.484	0.9433E-01	0.7397	0.6090
Lower	0.0000	0.0000	0.8501	1.690	0.6350
Total	1.356	2.699	2.180	3.664	2.475
Other Fluxes-lb/ac					
N Mineralization	21.61	19.32	19.92	19.36	20.05
P Mineralization	2.770	2.743	2.559	2.209	2.570
Denitrification	4.172	6.168	2.078	2.455	3.718
N Immobilization	27.44	26.87	27.62	24.49	26.60
P Immobilization	21.44	23.71	20.87	20.98	21.75

AGCHEM RESULTS FOR SHENANDOAH (HAY), SEGMENT 196

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	43.65	42.99	30.45	43.61	40.17
Runoff (in)					
Surface	9.811	7.853	1.582	6.630	6.469
Interflow	2.438	2.491	0.8270	2.157	1.978
Baseflow	7.159	5.821	4.034	5.650	5.666
Total	19.41	16.16	6.444	14.44	14.11
Sediment Loss (t/a)	0.7640	0.7510	0.1110	0.6820	0.5770
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.6038	0.3131	0.8451E-01	0.3273	0.3322
Interflow	1.081	0.8509	0.4196	1.028	0.8449
Baseflow	3.258	1.854	1.373	2.406	2.223
Total	4.943	3.018	1.877	3.762	3.400
NH3 Loss					
Surface	0.9890	0.3337	0.1478	0.3741	0.4611
Interflow	0.6058E-01	0.6783E-01	0.4962E-01	0.4995E-01	0.5700E-01
Baseflow	0.3678E-01	0.8706E-02	0.2978E-02	0.2619E-02	0.1277E-01
Sediment	0.8143E-02	0.7690E-02	0.1182E-02	0.7217E-02	0.6058E-02
Total	1.095	0.4179	0.2016	0.4339	0.5371
ORGN Sediment	2.127	2.138	0.3088	1.911	1.621
Total N Loss (lb/a)	8.165	5.574	2.388	6.107	5.559
PO4 Loss					
Surface	1.287	0.5291	0.3795	0.7280	0.7309
Interflow	0.1617	0.1372	0.5257E-01	0.2094	0.1402
Baseflow	0.6426E-03	0.4208E-05	0.8614E-06	0.4387E-06	0.1620E-03
Sediment	0.3867E-01	0.3871E-01	0.6658E-02	0.3872E-01	0.3069E-01
Total	1.489	0.7050	0.4387	0.9761	0.9022
ORGP Sediment	0.5728	0.5998	0.8567E-01	0.5226	0.4452
Total P Loss (lb/a)	2.061	1.305	0.5244	1.499	1.347
Atm Depn. NO3 (lb/a)	6.639	6.417	6.019	6.635	6.428
Atm Depn. NH4 (lb/a)	2.245	2.070	1.775	2.204	2.074
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	28.31	28.31	28.31	28.31	28.31
Nitrate appln.(lb/a)	7.320	7.320	7.320	7.320	7.320
ORGN appln.(lb/a)	8.760	8.760	8.760	8.760	8.760
Total N appln.(lb/a)	44.39	44.39	44.39	44.39	44.39
PO4-p appln.(lb/a)	27.48	27.48	27.48	27.48	27.48
ORGP appln.(lb/a)	3.360	3.360	3.360	3.360	3.360
Total P appln.(lb/a)	30.84	30.84	30.84	30.84	30.84
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.4000E-02	0.4000E-02	0.1000E-02	0.6000E-02	0.3750E-02
Upper	32.82	33.44	33.49	32.25	33.00
Lower	12.84	12.84	12.84	12.84	12.84
Total	45.66	46.28	46.33	45.09	45.84
Phosphorus					
Surface	0.8000E-02	0.8000E-02	0.2000E-02	0.1100E-01	0.7250E-02
Upper	15.94	15.94	15.94	15.93	15.94
Lower	3.002	3.001	3.001	1.924	2.732
Total	18.95	18.95	18.94	17.86	18.68
Deficit (lb/a)					
Nitrogen					
Surface	0.4959	0.4959	0.4994	0.4945	0.4964
Upper	3.910	3.292	3.236	4.462	3.725
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	4.406	3.788	3.735	4.957	4.222
Phosphorus					
Surface	0.9928	0.9924	0.9988	0.9895	0.9934
Upper	0.8367E-01	0.7382E-01	0.7985E-01	0.8734E-01	0.8117E-01
Lower	0.0000	0.0000	0.0000	1.077	0.2693
Total	1.076	1.066	1.079	2.154	1.344
Other Fluxes-lb/ac					
N Mineralization	19.27	19.33	19.17	18.95	19.18
P Mineralization	2.342	2.351	2.244	1.954	2.223
Denitrification	4.162	3.366	3.511	4.291	3.832
N Immobilization	8.629	9.451	9.354	9.358	9.198
P Immobilization	11.51	13.02	9.969	12.05	11.64

AGCHEM RESULTS FOR SHENANDOAH (HAY), SEGMENT 196

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	31.42	45.43	41.84	35.51	38.55
Runoff (in)					
Surface	1.105	7.414	6.983	4.666	5.042
Interflow	0.8380	2.648	2.215	1.403	1.776
Baseflow	4.515	6.778	6.172	5.363	5.707
Total	6.459	16.84	15.37	11.43	12.53
Sediment Loss (t/a)	0.3172E-01	0.3910	0.6190	0.2550	0.3242
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.8371E-01	0.8091	0.3771	0.3427	0.4032
Interflow	0.3441	0.9187	1.052	0.7893	0.7760
Baseflow	1.864	2.806	2.126	1.870	2.167
Total	2.292	4.533	3.554	3.002	3.345
NH3 Loss					
Surface	0.1325	1.693	0.4345	0.5063	0.6916
Interflow	0.3004E-01	0.7837E-01	0.6507E-01	0.4064E-01	0.5353E-01
Baseflow	0.1467E-02	0.1825E-02	0.1438E-02	0.1245E-02	0.1494E-02
Sediment	0.2821E-03	0.4695E-02	0.6529E-02	0.2905E-02	0.3603E-02
Total	0.1643	1.778	0.5075	0.5511	0.7502
ORGN Sediment	0.7174E-01	1.078	1.757	0.7028	0.9024
Total N Loss (lb/a)	2.528	7.389	5.819	4.256	4.998
PO4 Loss					
Surface	0.1990	1.559	0.8449	1.101	0.9260
Interflow	0.5241E-01	0.1152	0.9546E-01	0.6456E-01	0.8191E-01
Baseflow	0.1353E-06	0.8790E-07	0.8993E-07	0.8978E-07	0.1007E-06
Sediment	0.1425E-02	0.2458E-01	0.3428E-01	0.1626E-01	0.1914E-01
Total	0.2528	1.699	0.9746	1.182	1.027
ORGP Sediment	0.1926E-01	0.2994	0.4902	0.1917	0.2501
Total P Loss (lb/a)	0.2721	1.998	1.465	1.374	1.277
Atm Depn. NO3 (lb/a)	5.997	7.040	6.498	6.097	6.408
Atm Depn. NH4 (lb/a)	1.852	2.618	2.130	1.833	2.108
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	28.31	27.56	28.31	27.79	27.99
Nitrate appln.(lb/a)	7.320	7.070	7.320	7.145	7.214
ORGN appln.(lb/a)	8.760	8.760	8.760	8.760	8.760
Total N appln.(lb/a)	44.39	43.39	44.39	43.69	43.96
PO4-p appln.(lb/a)	27.48	26.65	27.48	26.90	27.13
ORGP appln.(lb/a)	3.360	3.360	3.360	3.360	3.360
Total P appln.(lb/a)	30.84	30.01	30.84	30.26	30.49
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.4000E-02	0.1000E-01	0.4000E-02	0.4000E-02	0.5500E-02
Upper	34.54	32.10	33.10	32.45	33.05
Lower	12.84	12.84	12.84	12.84	12.84
Total	47.38	44.94	45.94	45.29	45.89
Phosphorus					
Surface	0.7000E-02	0.1900E-01	0.8000E-02	0.8000E-02	0.1050E-01
Upper	15.92	15.92	15.94	15.96	15.94
Lower	1.045	0.9250	0.7650	0.6860	0.8553
Total	16.97	16.86	16.71	16.66	16.80
Deficit (lb/a)					
Nitrogen					
Surface	0.4963	0.4900	0.4959	0.4960	0.4945
Upper	2.184	4.617	3.622	4.291	3.678
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	2.680	5.107	4.118	4.787	4.173
Phosphorus					
Surface	0.9937	0.9817	0.9926	0.9929	0.9902
Upper	0.9447E-01	0.9779E-01	0.7546E-01	0.5295E-01	0.8017E-01
Lower	1.958	2.077	2.237	2.316	2.147
Total	3.046	3.156	3.305	3.362	3.217
Other Fluxes-lb/ac					
N Mineralization	19.46	19.25	19.36	19.19	19.31
P Mineralization	1.662	1.709	1.712	1.579	1.665
Denitrification	4.040	4.448	3.901	3.882	4.068
N Immobilization	9.439	9.079	9.592	9.291	9.350
P Immobilization	12.10	12.01	10.65	8.520	10.82

AGCHEM RESULTS FOR SHENANDOAH (HI-TILL), SEGMENT 202

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	39.78	36.84	27.99	37.57	35.54
Runoff (in)					
Surface	9.001	4.544	1.973	5.008	5.131
Interflow	3.480	3.032	1.403	2.687	2.650
Baseflow	6.224	4.998	4.168	4.608	4.999
Total	18.70	12.57	7.544	12.30	12.78
Sediment Loss (t/a)	1.660	0.4610	0.2090	0.5850	0.7288
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.9336	0.2277	0.3440	0.4281	0.4833
Interflow	11.24	8.840	6.672	9.341	9.023
Baseflow	2.820	1.738	1.615	2.560	2.183
Total	14.99	10.81	8.632	12.33	11.69
NH3 Loss					
Surface	2.766	0.3425	1.390	1.644	1.536
Interflow	1.082	1.552	1.534	1.762	1.482
Baseflow	0.3214E-01	0.7711E-02	0.3390E-02	0.2456E-02	0.1142E-01
Sediment	0.1978E-01	0.4726E-02	0.2658E-02	0.6598E-02	0.8441E-02
Total	3.900	1.907	2.931	3.415	3.038
ORGN Sediment	5.729	1.607	0.7419	1.998	2.519
Total N Loss (lb/a)	24.62	14.32	12.30	17.74	17.25
PO4 Loss					
Surface	1.042	0.5627	0.9401	0.8519	0.8492
Interflow	0.4315	1.027	0.5439	1.038	0.7601
Baseflow	0.5401E-03	0.1690E-05	0.1398E-05	0.2451E-05	0.1364E-03
Sediment	0.9119E-01	0.2498E-01	0.1343E-01	0.3400E-01	0.4090E-01
Total	1.565	1.614	1.497	1.924	1.650
ORGP Sediment	1.610	0.4525	0.2056	0.5640	0.7080
Total P Loss (lb/a)	3.175	2.067	1.703	2.488	2.358
Atm Depn. NO3 (lb/a)	6.464	6.154	5.854	6.257	6.182
Atm Depn. NH4 (lb/a)	2.118	1.894	1.670	1.964	1.911
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	123.1	124.2	124.2	124.2	123.9
Nitrate appln.(lb/a)	27.08	27.42	27.42	27.42	27.34
ORGN appln.(lb/a)	51.47	51.47	51.47	51.47	51.47
Total N appln.(lb/a)	201.6	203.1	203.1	203.1	202.7
PO4-P appln.(lb/a)	42.78	43.43	43.43	43.43	43.27
ORGP appln.(lb/a)	11.12	11.12	11.12	11.12	11.12
Total P appln.(lb/a)	53.90	54.55	54.55	54.55	54.39
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.1900E-01	0.1000E-01	0.3000E-02	0.1500E-01	0.1175E-01
Upper	75.22	76.68	80.95	81.30	78.54
Lower	52.24	57.09	57.10	57.07	55.88
Total	127.5	133.8	138.0	138.4	134.4
Phosphorus					
Surface	0.1800E-01	0.9000E-02	0.3000E-02	0.1300E-01	0.1075E-01
Upper	21.59	22.33	22.32	22.30	22.14
Lower	1.848	2.868	3.108	4.203	3.007
Total	23.46	25.20	25.43	26.51	25.15
Deficit (lb/a)					
Nitrogen					
Surface	1.432	1.441	1.448	1.436	1.439
Upper	11.61	10.17	6.026	5.555	8.340
Lower	4.968	0.0000	0.0000	0.0000	1.242
Total	18.01	11.61	7.474	6.991	11.02
Phosphorus					
Surface	1.383	1.392	1.398	1.387	1.390
Upper	0.8309	0.1021	0.1021	0.1176	0.2882
Lower	2.355	1.335	1.095	0.0000	1.196
Total	4.569	2.829	2.594	1.505	2.874
Other Fluxes-lb/ac					
N Mineralization	19.14	21.62	22.12	22.36	21.31
P Mineralization	1.888	2.230	2.119	2.396	2.158
Denitrification	3.504	3.926	4.163	5.860	4.363
N Immobilization	22.95	25.73	25.74	25.11	24.88
P Immobilization	11.54	18.44	14.52	19.30	15.95

AGCHEM RESULTS FOR SHENANDOAH (HI-TILL), SEGMENT 202

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	28.82	38.09	39.88	28.66	33.86
Runoff (in)					
Surface	2.796	5.344	6.123	3.020	4.321
Interflow	1.500	2.632	2.951	1.467	2.138
Baseflow	3.738	4.789	5.249	4.139	4.479
Total	8.033	12.77	14.32	8.625	10.94
Sediment Loss (t/a)	0.3410	0.7170	1.170	0.4750	0.6758
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.2560	0.5512	0.4906	0.3417	0.4099
Interflow	12.51	14.57	11.19	6.170	11.11
Baseflow	1.990	4.019	1.862	1.489	2.340
Total	14.76	19.14	13.55	8.001	13.86
NH3 Loss					
Surface	0.4440	1.668	2.366	0.7698	1.312
Interflow	1.391	1.391	1.617	0.9523	1.338
Baseflow	0.1505E-02	0.1511E-02	0.1289E-02	0.1199E-02	0.1376E-02
Sediment	0.3936E-02	0.1035E-01	0.1378E-01	0.5812E-02	0.8470E-02
Total	1.841	3.072	3.998	1.729	2.660
ORGN Sediment	1.166	2.503	4.138	1.637	2.361
Total N Loss (lb/a)	17.76	24.71	21.68	11.37	18.88
PO4 Loss					
Surface	0.6633	1.244	1.555	0.6319	1.024
Interflow	1.057	1.294	0.8371	0.4463	0.9086
Baseflow	0.1740E-05	0.2185E-05	0.1238E-05	0.9801E-06	0.1536E-05
Sediment	0.2187E-01	0.4370E-01	0.7004E-01	0.2843E-01	0.4101E-01
Total	1.743	2.582	2.462	1.107	1.973
ORGP Sediment	0.3305	0.7043	1.171	0.4608	0.6666
Total P Loss (lb/a)	2.073	3.286	3.633	1.567	2.640
Atm Depn. NO3 (lb/a)	5.703	6.603	6.329	5.688	6.081
Atm Depn. NH4 (lb/a)	1.684	2.303	2.051	1.537	1.894
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	124.2	106.4	123.2	118.5	118.1
Nitrate appln.(lb/a)	27.42	21.48	27.13	25.53	25.39
ORGN appln.(lb/a)	51.47	51.47	51.47	51.47	51.47
Total N appln.(lb/a)	203.1	179.3	201.9	195.5	195.0
PO4-P appln.(lb/a)	43.43	43.34	42.87	43.43	43.27
ORGP appln.(lb/a)	11.12	11.12	11.12	11.12	11.12
Total P appln.(lb/a)	54.55	54.46	53.99	54.55	54.39
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.1500E-01	0.1300E-01	0.2000E-01	0.5000E-02	0.1325E-01
Upper	67.09	61.04	71.65	75.63	68.85
Lower	57.07	55.80	57.06	56.65	56.64
Total	124.2	116.9	128.7	132.3	125.5
Phosphorus					
Surface	0.1200E-01	0.1200E-01	0.1500E-01	0.6000E-02	0.1125E-01
Upper	22.30	22.28	22.33	22.36	22.32
Lower	4.203	4.202	3.007	2.251	3.416
Total	26.51	26.50	25.35	24.62	25.75
Deficit (lb/a)					
Nitrogen					
Surface	1.436	1.437	1.431	1.445	1.437
Upper	19.70	25.77	15.20	11.23	17.98
Lower	0.0000	1.286	0.0000	0.4290	0.4288
Total	21.13	28.49	16.63	13.10	19.84
Phosphorus					
Surface	1.389	1.389	1.386	1.395	1.390
Upper	0.1273	0.1322	0.9377E-01	0.6556E-01	0.1047
Lower	0.0000	0.0000	1.196	1.951	0.7868
Total	1.516	1.521	2.676	3.412	2.281
Other Fluxes-lb/ac					
N Mineralization	21.31	17.57	20.48	21.20	20.14
P Mineralization	2.413	2.461	2.071	1.931	2.219
Denitrification	5.485	7.105	4.009	3.776	5.094
N Immobilization	25.68	21.64	25.50	23.87	24.17
P Immobilization	16.33	21.74	17.33	14.75	17.54

AGCHEM RESULTS FOR SHENANDOAH (LOW-TILL), SEGMENT 203

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	39.78	36.84	27.99	37.57	35.54
Runoff (in)					
Surface	7.438	3.413	1.345	3.533	3.932
Interflow	3.401	2.963	1.350	2.505	2.555
Baseflow	6.670	5.437	4.426	4.937	5.368
Total	17.51	11.81	7.121	10.97	11.85
Sediment Loss (t/a)	0.9900	0.2920	0.1140	0.3020	0.4245
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.9958	0.1578	0.3093	0.3807	0.4609
Interflow	9.218	8.381	5.402	6.978	7.495
Baseflow	2.368	0.9491	0.6116	1.450	1.345
Total	12.58	9.488	6.323	8.809	9.300
NH3 Loss					
Surface	2.777	0.3127	1.261	1.000	1.338
Interflow	0.9135	1.290	1.450	1.578	1.308
Baseflow	0.3298E-01	0.7316E-02	0.2973E-02	0.2282E-02	0.1139E-01
Sediment	0.1152E-01	0.2908E-02	0.1404E-02	0.3340E-02	0.4793E-02
Total	3.735	1.613	2.716	2.584	2.662
ORGN Sediment	4.267	1.266	0.4980	1.289	1.830
Total N Loss (lb/a)	20.58	12.37	9.537	12.68	13.79
PO4 Loss					
Surface	1.181	0.5983	0.8536	0.8979	0.8827
Interflow	0.3777	0.6366	0.3922	0.6917	0.5246
Baseflow	0.5433E-03	0.9928E-06	0.7342E-06	0.1391E-05	0.1366E-03
Sediment	0.5266E-01	0.1549E-01	0.7340E-02	0.1716E-01	0.2316E-01
Total	1.612	1.250	1.253	1.607	1.430
ORGP Sediment	1.138	0.3392	0.1333	0.3445	0.4887
Total P Loss (lb/a)	2.750	1.590	1.386	1.951	1.919
Atm Depn. NO3 (lb/a)	6.464	6.154	5.854	6.257	6.182
Atm Depn. NH4 (lb/a)	2.118	1.894	1.670	1.964	1.911
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	124.6	125.9	125.9	125.9	125.6
Nitrate appln.(lb/a)	28.96	29.39	29.39	29.39	29.28
ORGN appln.(lb/a)	54.54	54.54	54.54	54.54	54.54
Total N appln.(lb/a)	208.1	209.9	209.9	209.9	209.4
PO4-P appln.(lb/a)	42.36	43.12	43.12	43.12	42.93
ORGP appln.(lb/a)	14.70	14.70	14.70	14.70	14.70
Total P appln.(lb/a)	57.06	57.82	57.82	57.82	57.63
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.4000E-01	0.2300E-01	0.5000E-02	0.2500E-01	0.2325E-01
Upper	82.25	84.56	92.05	91.31	87.54
Lower	51.57	59.38	50.54	56.37	54.46
Total	133.9	144.0	142.6	147.7	142.0
Phosphorus					
Surface	0.3400E-01	0.1900E-01	0.5000E-02	0.2000E-01	0.1950E-01
Upper	21.17	21.84	22.31	22.29	21.90
Lower	1.836	2.184	1.971	3.195	2.296
Total	23.03	24.04	24.29	25.51	24.22
Deficit (lb/a)					
Nitrogen					
Surface	1.511	1.528	1.545	1.526	1.528
Upper	10.63	8.491	1.038	1.629	5.447
Lower	9.671	1.737	10.48	4.724	6.653
Total	21.81	11.76	13.07	7.879	13.63
Phosphorus					
Surface	1.367	1.382	1.396	1.380	1.381
Upper	1.257	0.5821	0.1021	0.1176	0.5147
Lower	2.368	2.019	2.231	1.007	1.906
Total	4.991	3.983	3.729	2.505	3.802
Other Fluxes-lb/ac					
N Mineralization	19.15	21.51	19.86	22.31	20.71
P Mineralization	2.115	2.318	2.198	2.416	2.262
Denitrification	2.550	1.953	1.127	3.195	2.206
N Immobilization	23.61	26.77	26.83	26.21	25.85
P Immobilization	14.44	20.40	16.04	21.02	17.97

AGCHEM RESULTS FOR SHENANDOAH (LOW-TILL), SEGMENT 203

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	28.82	38.09	39.88	28.66	33.86
Runoff (in)					
Surface	1.932	3.814	4.912	2.401	3.265
Interflow	1.441	2.476	2.906	1.419	2.060
Baseflow	4.146	5.137	5.669	4.391	4.836
Total	7.519	11.43	13.49	8.211	10.16
Sediment Loss (t/a)	0.1710	0.3710	0.6860	0.2850	0.3782
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.1699	0.3872	0.7875	0.2571	0.4004
Interflow	11.34	14.09	11.94	4.749	10.53
Baseflow	1.220	2.493	1.287	0.5848	1.396
Total	12.73	16.97	14.01	5.590	12.33
NH3 Loss					
Surface	0.3515	1.402	3.524	0.6787	1.489
Interflow	1.396	1.159	1.412	0.9226	1.222
Baseflow	0.1497E-02	0.1396E-02	0.1213E-02	0.1158E-02	0.1316E-02
Sediment	0.1854E-02	0.5088E-02	0.8063E-02	0.3632E-02	0.4659E-02
Total	1.751	2.567	4.945	1.606	2.717
ORGN Sediment	0.7228	1.595	3.017	1.228	1.641
Total N Loss (lb/a)	15.20	21.13	21.97	8.425	16.68
PO4 Loss					
Surface	0.6955	1.285	1.746	0.6217	1.087
Interflow	0.9323	1.091	0.5800	0.2848	0.7220
Baseflow	0.1171E-05	0.1474E-05	0.7273E-06	0.5229E-06	0.9738E-06
Sediment	0.1044E-01	0.2215E-01	0.4029E-01	0.1729E-01	0.2254E-01
Total	1.638	2.399	2.366	0.9238	1.832
ORGP Sediment	0.1942	0.4260	0.8096	0.3279	0.4394
Total P Loss (lb/a)	1.832	2.825	3.176	1.252	2.271
Atm Depn. NO3 (lb/a)	5.703	6.603	6.329	5.688	6.081
Atm Depn. NH4 (lb/a)	1.684	2.303	2.051	1.537	1.894
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	125.9	105.2	124.8	119.8	118.9
Nitrate appln.(lb/a)	29.39	22.48	29.02	27.34	27.06
ORGN appln.(lb/a)	54.54	54.54	54.54	54.54	54.54
Total N appln.(lb/a)	209.9	182.2	208.4	201.6	200.5
PO4-P appln.(lb/a)	43.12	43.01	42.47	43.12	42.93
ORGP appln.(lb/a)	14.70	14.70	14.70	14.70	14.70
Total P appln.(lb/a)	57.82	57.71	57.17	57.82	57.63
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.2000E-01	0.2200E-01	0.2700E-01	0.8000E-02	0.1925E-01
Upper	78.76	62.74	75.63	88.73	76.46
Lower	58.62	49.70	59.76	47.36	53.86
Total	137.4	112.5	135.4	136.1	130.3
Phosphorus					
Surface	0.1500E-01	0.1800E-01	0.2000E-01	0.7000E-02	0.1500E-01
Upper	22.30	20.30	22.07	22.36	21.76
Lower	3.111	3.560	1.974	1.397	2.510
Total	25.43	23.88	24.06	23.76	24.28
Deficit (lb/a)					
Nitrogen					
Surface	1.532	1.529	1.523	1.543	1.532
Upper	14.05	30.02	17.27	4.163	16.38
Lower	2.465	11.32	1.355	13.65	7.197
Total	18.04	42.86	20.15	19.36	25.10
Phosphorus					
Surface	1.386	1.383	1.381	1.394	1.386
Upper	0.1273	2.107	0.3545	0.6556E-01	0.6636
Lower	1.093	0.6431	2.228	2.805	1.692
Total	2.606	4.134	3.964	4.264	3.742
Other Fluxes-lb/ac					
N Mineralization	21.06	16.48	19.97	18.64	19.04
P Mineralization	2.293	2.463	2.101	2.009	2.217
Denitrification	2.612	3.947	2.526	1.169	2.563
N Immobilization	26.36	21.55	26.24	24.36	24.63
P Immobilization	17.32	22.20	19.17	15.84	18.63

AGCHEM RESULTS FOR SHENANDOAH (HAY), SEGMENT 206

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	39.78	36.84	27.99	37.57	35.54
Runoff (in)					
Surface	6.998	3.215	1.060	2.775	3.512
Interflow	2.458	1.945	0.7600	1.580	1.686
Baseflow	6.566	5.063	4.028	4.531	5.047
Total	16.02	10.22	5.848	8.886	10.24
Sediment Loss (t/a)	0.7220	0.2190	0.6218E-01	0.1660	0.2923
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.4650	0.1504	0.9988E-01	0.1466	0.2155
Interflow	1.228	0.3914	0.4585	0.8801	0.7395
Baseflow	2.955	1.462	1.123	1.659	1.800
Total	4.648	2.003	1.682	2.686	2.755
NH3 Loss					
Surface	0.7730	0.1305	0.2122	0.1964	0.3280
Interflow	0.5607E-01	0.3661E-01	0.5950E-01	0.5215E-01	0.5108E-01
Baseflow	0.3273E-01	0.7037E-02	0.2677E-02	0.1827E-02	0.1107E-01
Sediment	0.7866E-02	0.2134E-02	0.6718E-03	0.1664E-02	0.3084E-02
Total	0.8697	0.1763	0.2751	0.2520	0.3933
ORGN Sediment	2.017	0.5983	0.1667	0.4436	0.8064
Total N Loss (lb/a)	7.535	2.778	2.123	3.382	3.954
PO4 Loss					
Surface	0.8707	0.1663	0.4592	0.4121	0.4771
Interflow	0.1746	0.1245	0.6414E-01	0.2026	0.1415
Baseflow	0.5453E-03	0.2077E-06	0.1670E-06	0.3875E-06	0.1365E-03
Sediment	0.3861E-01	0.1083E-01	0.3945E-02	0.8831E-02	0.1555E-01
Total	1.084	0.3016	0.5273	0.6235	0.6341
ORGP Sediment	0.5464	0.1655	0.4560E-01	0.1198	0.2193
Total, P Loss (lb/a)	1.631	0.4672	0.5729	0.7433	0.8536
Atm Depn. NO3 (lb/a)	6.464	6.154	5.854	6.257	6.182
Atm Depn. NH4 (lb/a)	2.118	1.894	1.670	1.964	1.911
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	28.31	28.31	28.31	28.31	28.31
Nitrate appln.(lb/a)	7.320	7.320	7.320	7.320	7.320
ORGN appln.(lb/a)	8.760	8.760	8.760	8.760	8.760
Total N appln.(lb/a)	44.39	44.39	44.39	44.39	44.39
PO4-p appln.(lb/a)	27.48	27.48	27.48	27.48	27.48
ORGP appln.(lb/a)	3.360	3.360	3.360	3.360	3.360
Total P appln.(lb/a)	30.84	30.84	30.84	30.84	30.84
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.9000E-02	0.3000E-02	0.1000E-02	0.6000E-02	0.4750E-02
Upper	32.41	35.49	34.71	32.15	33.69
Lower	12.84	12.84	12.84	12.84	12.84
Total	45.26	48.33	47.54	44.99	46.53
Phosphorus					
Surface	0.1600E-01	0.7000E-02	0.2000E-02	0.1000E-01	0.8750E-02
Upper	15.95	15.94	15.94	15.93	15.94
Lower	1.490	0.9240	0.9610	1.970	1.336
Total	17.46	16.87	16.91	17.91	17.29
Deficit (lb/a)					
Nitrogen					
Surface	0.4914	0.4968	0.4991	0.4945	0.4955
Upper	4.310	1.251	2.030	4.572	3.041
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	4.802	1.748	2.529	5.067	3.536
Phosphorus					
Surface	0.9846	0.9937	0.9984	0.9905	0.9918
Upper	0.7094E-01	0.7296E-01	0.7290E-01	0.8399E-01	0.7520E-01
Lower	1.513	2.077	2.041	1.032	1.666
Total	2.568	3.144	3.112	2.106	2.732
Other Fluxes-lb/ac					
N Mineralization	19.23	19.60	19.31	18.99	19.28
P Mineralization	1.831	1.801	1.658	1.956	1.811
Denitrification	4.290	3.140	3.076	3.918	3.606
N Immobilization	8.689	9.516	9.189	9.355	9.187
P Immobilization	11.54	12.27	8.714	14.24	11.69

AGCHEM RESULTS FOR SHENANDOAH (HAY), SEGMENT 206

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	28.82	38.09	39.88	28.66	33.86
Runoff (in)					
Surface	1.269	3.090	4.584	2.126	2.767
Interflow	0.8230	1.639	2.004	0.9720	1.359
Baseflow	3.928	4.760	5.488	4.383	4.640
Total	6.021	9.490	12.08	7.481	8.767
Sediment Loss (t/a)	0.7286E-01	0.1980	0.5660	0.2000	0.2592
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.8922E-01	0.3405	0.1907	0.1921	0.2031
Interflow	0.2939	0.6761	0.7594	0.6046	0.5835
Baseflow	1.566	2.321	2.113	1.466	1.867
Total	1.950	3.338	3.063	2.263	2.654
NH3 Loss					
Surface	0.1106	0.5248	0.2438	0.3057	0.2962
Interflow	0.2738E-01	0.4875E-01	0.4028E-01	0.2672E-01	0.3578E-01
Baseflow	0.1138E-02	0.1149E-02	0.1177E-02	0.9174E-03	0.1095E-02
Sediment	0.7340E-03	0.2374E-02	0.5916E-02	0.2450E-02	0.2869E-02
Total	0.1399	0.5771	0.2912	0.3357	0.3360
ORGN Sediment	0.1917	0.5332	1.601	0.5522	0.7195
Total N Loss (lb/a)	2.281	4.448	4.955	3.150	3.708
PO4 Loss					
Surface	0.1929	0.7599	0.6552	0.7940	0.6005
Interflow	0.5032E-01	0.9320E-01	0.8933E-01	0.4564E-01	0.6962E-01
Baseflow	0.1432E-06	0.9722E-07	0.7523E-07	0.8653E-07	0.1005E-06
Sediment	0.3770E-02	0.1263E-01	0.3120E-01	0.1408E-01	0.1542E-01
Total	0.2470	0.8657	0.7757	0.8538	0.6856
ORGP Sediment	0.5159E-01	0.1462	0.4432	0.1478	0.1972
Total P Loss (lb/a)	0.2986	1.012	1.219	1.002	0.8829
Atm Depn. NO3 (lb/a)	5.703	6.603	6.329	5.688	6.081
Atm Depn. NH4 (lb/a)	1.684	2.303	2.051	1.537	1.894
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	28.31	27.81	27.58	27.79	27.87
Nitrate appln.(lb/a)	7.320	7.153	7.076	7.145	7.174
ORGN appln.(lb/a)	8.760	8.760	8.760	8.760	8.760
Total N appln.(lb/a)	44.39	43.72	43.42	43.69	43.80
PO4-p appln.(lb/a)	27.48	26.93	26.68	26.90	27.00
ORGP appln.(lb/a)	3.360	3.360	3.360	3.360	3.360
Total P appln.(lb/a)	30.84	30.29	30.04	30.26	30.36
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.6000E-02	0.6000E-02	0.6000E-02	0.1000E-02	0.4750E-02
Upper	32.26	33.50	33.31	32.56	32.91
Lower	12.84	12.84	12.84	12.84	12.84
Total	45.10	46.35	46.15	45.40	45.75
Phosphorus					
Surface	0.1000E-01	0.1100E-01	0.1000E-01	0.3000E-02	0.8500E-02
Upper	15.93	15.92	15.94	15.96	15.94
Lower	1.087	0.9490	0.8110	0.6310	0.8695
Total	17.03	16.88	16.76	16.60	16.82
Deficit (lb/a)					
Nitrogen					
Surface	0.4948	0.4940	0.4937	0.4990	0.4954
Upper	4.458	3.227	3.424	4.192	3.825
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	4.952	3.721	3.918	4.691	4.321
Phosphorus					
Surface	0.9908	0.9892	0.9901	0.9978	0.9920
Upper	0.9095E-01	0.9446E-01	0.6698E-01	0.4683E-01	0.7480E-01
Lower	1.916	2.053	2.190	2.371	2.132
Total	2.998	3.136	3.248	3.415	3.199
Other Fluxes-lb/ac					
N Mineralization	19.71	19.53	19.30	19.03	19.39
P Mineralization	1.615	1.737	1.660	1.511	1.631
Denitrification	4.478	5.159	4.298	3.850	4.446
N Immobilization	9.673	9.537	9.342	9.176	9.432
P Immobilization	11.18	13.20	10.97	7.684	10.76

Percent of Total Load Contributed from Each Land Use in Shenandoah Basin

Segment 190

		Pervious						Impervious		Point	Total
		FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Source	Load
NH3											
	84	1.74	6.24	15.88	1.27	1.76	6.21	5.00	1.07	60.85	100.00
	85	1.94	3.59	7.17	1.32	2.30	3.27	6.76	1.33	72.31	100.00
	86	1.15	3.72	8.28	0.67	0.63	1.68	4.08	1.49	78.32	100.00
	87	1.65	4.61	9.81	1.03	1.59	2.98	5.96	1.26	71.14	100.00
	88	1.09	2.91	6.45	0.64	0.43	1.26	4.18	1.33	81.68	100.00
	89	1.88	8.37	14.84	1.12	1.31	11.77	5.76	1.31	53.66	100.00
	90	1.87	6.89	16.64	1.14	1.66	3.80	5.95	1.40	60.63	100.00
	91	1.91	5.00	10.34	1.16	1.32	4.92	5.89	1.59	67.88	100.00
MEAN		1.66	5.29	11.49	1.06	1.40	4.69	5.44	1.33	67.63	100.00
NO3											
	84	17.62	8.03	16.40	29.80	11.82	12.58	0.56	1.06	2.12	100.00
	85	19.44	8.52	16.93	31.06	11.76	8.53	0.61	1.05	2.10	100.00
	86	20.59	9.59	16.17	29.05	9.87	9.14	0.59	1.90	3.09	100.00
	87	18.20	9.28	16.21	28.95	11.38	11.63	0.67	1.26	2.42	100.00
	88	15.90	12.55	24.31	24.99	8.47	9.10	0.54	1.52	2.60	100.00
	89	14.99	11.23	22.81	26.86	10.03	10.93	0.52	1.04	1.60	100.00
	90	18.28	9.87	20.67	27.78	10.39	9.56	0.53	1.11	1.79	100.00
	91	20.25	9.02	17.57	28.33	10.34	10.33	0.57	1.36	2.24	100.00
MEAN		17.98	9.70	18.95	28.42	10.62	10.36	0.57	1.23	2.16	100.00
ORGN											
	84	13.47	4.53	9.38	15.16	10.78	10.77	26.76	3.01	6.14	100.00
	85	9.24	8.15	16.84	10.28	10.42	10.79	26.12	2.71	5.45	100.00
	86	8.26	2.69	4.84	11.06	5.64	4.41	41.88	8.04	13.17	100.00
	87	9.73	6.08	11.69	10.37	9.35	11.41	31.11	3.49	6.79	100.00
	88	6.48	1.35	2.04	11.10	3.22	1.08	49.03	8.24	17.46	100.00
	89	13.03	3.62	6.57	12.58	8.38	7.42	35.99	4.29	8.13	100.00
	90	10.02	4.93	10.01	10.97	9.58	11.54	31.32	3.88	7.75	100.00
	91	11.39	4.79	8.81	12.73	7.78	5.99	33.80	4.84	9.88	100.00
MEAN		10.66	5.06	9.99	11.91	8.93	9.06	32.14	4.13	8.11	100.00
TN											
	84	12.68	6.60	14.23	19.14	9.08	10.47	9.88	1.54	16.39	100.00
	85	12.94	7.34	14.79	19.05	9.41	8.05	10.90	1.56	15.97	100.00
	86	12.28	6.47	11.56	16.94	6.20	5.93	10.62	2.81	27.20	100.00
	87	11.94	7.22	13.28	17.32	8.43	9.40	11.69	1.81	18.91	100.00
	88	10.02	7.94	15.53	15.57	5.26	5.53	10.43	2.42	27.29	100.00
	89	11.59	8.91	17.47	18.14	7.69	10.20	10.52	1.73	13.75	100.00
	90	12.80	7.98	17.08	18.15	8.28	8.69	10.38	1.78	14.86	100.00
	91	14.03	7.06	13.77	18.60	7.67	8.03	10.91	2.15	17.78	100.00
MEAN		12.34	7.48	14.90	18.04	7.98	8.61	10.65	1.89	18.11	100.00
PO4											
	84	3.02	6.37	16.88	1.98	4.06	21.49	3.18	1.22	41.79	100.00
	85	2.10	7.74	13.22	1.89	5.27	13.48	4.12	1.45	50.74	100.00
	86	0.97	6.97	14.35	0.91	1.15	10.91	3.04	1.98	59.71	100.00
	87	2.09	7.78	15.05	1.45	3.55	16.78	3.73	1.42	48.15	100.00
	88	0.59	8.18	16.79	0.91	0.52	6.54	3.52	2.01	60.94	100.00
	89	2.34	11.35	22.90	1.54	2.63	28.64	3.67	1.48	25.47	100.00
	90	1.86	12.26	25.10	1.65	3.81	19.47	3.97	1.67	30.20	100.00
	91	2.35	7.42	15.51	1.61	2.69	27.46	3.84	1.86	37.25	100.00
MEAN		2.03	8.52	17.63	1.55	3.14	18.77	3.63	1.59	43.14	100.00
ORGP											
	84	9.74	6.35	12.66	10.96	7.79	14.68	22.56	2.18	13.09	100.00
	85	6.22	10.73	21.37	6.92	7.01	14.27	20.53	1.82	11.14	100.00
	86	5.62	3.54	6.15	7.52	3.83	5.83	33.23	5.47	28.82	100.00
	87	6.69	8.14	15.04	7.13	6.43	15.02	24.96	2.40	14.21	100.00
	88	4.33	1.76	2.55	7.40	2.15	1.35	38.17	5.50	36.82	100.00
	89	10.09	5.45	9.53	9.74	6.49	11.18	32.49	3.32	11.69	100.00
	90	7.35	7.03	13.75	8.05	7.03	16.54	26.82	2.85	10.57	100.00
	91	8.57	7.00	12.38	9.57	5.86	8.61	29.65	3.64	14.75	100.00
MEAN		7.59	7.02	13.34	8.48	6.36	12.44	26.71	2.95	15.11	100.00

Segment 190

	FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Point Source	Total Load
	<--------	--------	--------	Pervious	--------	--------><	----Impervious->			
TP										
84	5.23	6.11	14.76	5.01	5.19	18.29	13.67	1.50	30.22	100.00
85	3.76	8.68	16.11	3.95	5.78	13.23	15.30	1.55	31.65	100.00
86	2.12	5.80	11.64	2.57	1.79	9.14	14.90	2.79	49.25	100.00
87	3.64	7.55	14.37	3.42	4.42	15.40	15.61	1.70	33.85	100.00
88	1.52	6.13	12.32	2.53	0.91	4.89	17.13	2.80	51.77	100.00
89	4.52	9.05	17.83	3.89	3.64	22.08	16.83	1.96	20.16	100.00
90	3.72	9.83	19.89	3.84	4.77	17.52	16.63	2.01	21.81	100.00
91	4.25	6.92	13.74	4.12	3.59	20.02	16.85	2.35	28.15	100.00
MEAN	3.81	7.63	15.38	3.81	4.09	15.80	15.72	1.97	31.77	100.00
BOD										
84	11.75	10.91	15.22	13.21	9.39	21.78	8.41	2.63	6.68	100.00
85	6.64	19.96	27.35	7.39	7.49	18.18	6.78	1.95	4.26	100.00
86	9.01	7.02	9.46	12.05	6.15	11.96	16.47	8.77	19.11	100.00
87	7.77	15.31	20.15	8.28	7.47	21.76	8.96	2.78	7.52	100.00
88	7.49	5.13	8.10	12.82	3.72	5.29	20.43	9.52	27.51	100.00
89	11.89	10.80	15.38	11.47	7.65	17.09	11.84	3.92	9.94	100.00
90	8.08	13.67	19.10	8.84	7.72	22.00	9.11	3.13	8.38	100.00
91	10.44	13.32	16.01	11.67	7.13	13.48	11.17	4.43	12.36	100.00
MEAN	9.07	13.69	18.62	10.13	7.60	18.46	9.87	3.52	9.02	100.00
SED										
84	22.36	8.60	14.50	23.11	5.83	25.61	0.00	0.00	0.00	100.00
85	10.88	15.30	25.77	15.81	5.96	26.27	0.00	0.00	0.00	100.00
86	23.18	9.25	13.57	29.34	4.57	20.09	0.00	0.00	0.00	100.00
87	13.33	12.96	20.24	17.12	5.67	30.69	0.00	0.00	0.00	100.00
88	20.63	8.60	10.71	47.57	2.39	10.12	0.00	0.00	0.00	100.00
89	22.99	9.25	13.75	24.20	5.53	24.28	0.00	0.00	0.00	100.00
90	13.52	10.87	18.15	18.94	6.00	32.53	0.00	0.00	0.00	100.00
91	19.39	12.23	18.20	25.30	5.28	19.60	0.00	0.00	0.00	100.00
MEAN	17.08	11.46	18.42	21.19	5.64	26.23	0.00	0.00	0.00	100.00

Segment 200

		FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Point Source	Total Load
		<------	------	------	Pervious	------	------>	<----Impervious	->		
NH3											
	84	1.92	6.52	8.89	1.77	1.90	5.75	4.71	1.25	66.75	100.00
	85	1.93	6.56	8.94	1.78	1.91	5.78	4.74	1.26	67.13	100.00
	86	1.69	3.76	4.53	1.15	0.81	1.37	4.94	1.37	80.42	100.00
	87	1.17	5.83	7.70	0.77	0.52	2.16	3.13	1.43	77.32	100.00
	88	1.41	6.50	7.01	1.11	0.80	1.90	4.99	1.42	74.86	100.00
	89	1.18	3.71	5.02	0.67	0.49	1.11	3.52	1.38	82.97	100.00
	90	2.23	8.73	10.39	1.75	1.31	6.49	6.81	2.24	60.05	100.00
	91	2.38	10.22	18.02	1.92	1.50	2.95	7.00	1.96	54.05	100.00
MEAN		2.22	5.51	7.29	1.25	0.76	4.23	5.33	2.30	71.12	100.00
NO3											
	84	17.44	10.11	12.10	35.10	10.03	12.41	0.48	0.93	0.80	100.00
	85	19.22	9.79	11.71	35.24	9.87	12.01	0.46	0.90	0.78	100.00
	86	22.57	9.36	11.71	38.16	8.63	6.86	0.54	1.11	1.05	100.00
	87	23.02	10.78	11.25	34.87	8.25	8.31	0.49	1.63	1.37	100.00
	88	19.09	12.00	12.22	34.69	8.53	10.35	0.64	1.32	1.14	100.00
	89	16.88	16.10	19.79	28.72	7.10	8.42	0.48	1.36	1.15	100.00
	90	14.59	15.41	19.46	29.89	7.57	10.63	0.48	1.16	0.82	100.00
	91	19.77	10.28	15.15	34.77	8.47	9.20	0.52	1.06	0.77	100.00
MEAN		25.22	9.06	9.02	35.38	8.09	10.14	0.47	1.50	1.10	100.00
ORGN											
	84	13.31	7.33	7.78	18.36	10.33	10.21	21.65	2.31	1.56	100.00
	85	14.34	7.90	8.38	19.78	11.13	11.00	23.33	2.48	1.68	100.00
	86	12.43	4.40	4.94	16.01	6.51	6.49	41.20	4.57	3.44	100.00
	87	10.22	3.41	3.26	17.26	6.47	3.03	43.48	7.90	4.96	100.00
	88	10.00	5.34	4.91	18.19	6.93	4.69	42.01	4.76	3.18	100.00
	89	10.38	5.21	4.60	11.22	5.72	3.39	46.83	7.31	5.34	100.00
	90	13.40	6.30	5.72	18.14	7.29	5.31	36.22	4.75	2.86	100.00
	91	12.43	7.71	8.01	16.96	6.97	11.80	30.60	3.41	2.12	100.00
MEAN		7.25	6.65	7.11	13.30	4.72	8.87	40.75	7.04	4.30	100.00
TN											
	84	12.88	8.48	10.10	23.21	8.29	10.26	8.49	1.35	14.58	100.00
	85	14.16	8.51	10.13	23.97	8.40	10.30	8.52	1.36	14.64	100.00
	86	15.23	6.94	8.54	24.44	6.17	5.32	10.62	1.76	20.97	100.00
	87	13.75	7.96	8.80	20.76	5.36	5.44	8.92	2.42	26.58	100.00
	88	12.25	9.03	9.19	21.89	5.99	6.81	11.66	1.98	21.21	100.00
	89	11.05	10.68	13.02	17.53	4.83	5.43	9.19	2.15	26.13	100.00
	90	11.96	12.19	14.85	22.18	6.29	8.68	10.35	2.03	11.49	100.00
	91	14.72	9.48	13.69	24.36	6.77	8.58	10.47	1.75	10.19	100.00
MEAN		16.86	7.74	8.18	23.77	5.82	8.49	9.97	2.58	16.60	100.00
PO4											
	84	1.59	9.79	14.37	4.13	6.81	27.75	4.41	1.60	29.44	100.00
	85	1.60	9.89	14.52	4.17	6.88	27.13	4.46	1.62	29.74	100.00
	86	0.76	14.82	16.35	2.76	2.75	10.95	5.75	2.18	43.69	100.00
	87	0.46	13.84	16.51	1.62	1.55	19.29	3.64	2.25	40.87	100.00
	88	0.60	14.68	17.47	2.49	2.54	18.82	5.00	1.93	36.47	100.00
	89	0.48	15.92	21.32	1.16	1.39	8.92	3.99	2.12	44.70	100.00
	90	0.81	17.47	23.12	2.33	2.52	23.17	4.06	1.82	24.70	100.00
	91	0.96	16.91	23.16	2.98	3.34	21.08	4.70	1.79	25.08	100.00
MEAN		0.36	10.19	12.12	1.50	1.21	31.10	3.85	2.27	37.40	100.00
ORGP											
	84	10.56	11.44	11.52	14.56	8.19	15.36	20.03	1.83	5.90	100.00
	85	10.62	11.51	11.59	14.65	8.24	15.45	20.15	1.84	5.93	100.00
	86	9.26	6.47	6.91	11.93	4.85	9.36	35.80	3.41	12.00	100.00
	87	7.50	4.86	4.49	12.67	4.75	4.26	37.22	5.80	18.44	100.00
	88	7.50	7.92	6.89	13.65	5.19	6.65	36.77	3.57	11.84	100.00
	89	7.17	7.14	5.98	7.75	3.95	4.41	37.73	5.05	20.79	100.00
	90	10.22	9.46	8.16	13.83	5.56	7.77	32.22	3.62	9.15	100.00
	91	9.04	11.11	10.94	12.33	5.07	16.63	25.96	2.48	6.46	100.00
MEAN		5.03	9.08	9.21	9.23	3.27	11.53	32.98	4.88	14.80	100.00

Segment 200

		<---------------------------Pervious					------------------><----Impervious->		Point	Total
		FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Source	Load
TP											
	84	5.53	10.09	12.45	8.61	7.12	20.97	15.67	1.63	17.59	100.00
	85	5.57	10.17	12.55	8.68	7.18	20.66	15.80	1.65	17.73	100.00
	86	3.81	10.80	11.83	5.93	3.34	9.65	22.90	2.49	29.24	100.00
	87	2.32	10.75	12.47	4.49	2.33	14.31	17.40	3.09	32.84	100.00
	88	2.84	11.55	12.90	6.03	3.26	13.65	21.29	2.36	26.11	100.00
	89	2.34	12.60	15.87	2.96	2.04	7.18	18.58	2.83	35.61	100.00
	90	3.76	14.03	17.18	5.86	3.36	17.09	17.91	2.30	18.50	100.00
	91	4.13	13.72	17.10	6.55	3.86	18.22	18.09	1.97	16.37	100.00
MEAN		1.75	9.34	10.63	3.76	1.78	23.63	17.45	2.95	28.70	100.00
BOD											
	84	10.68	16.57	10.69	14.72	8.29	26.07	6.26	1.85	4.89	100.00
	85	10.68	16.57	10.69	14.72	8.29	26.07	6.26	1.85	4.89	100.00
	86	10.95	12.44	9.68	14.10	5.73	22.24	13.08	4.03	7.74	100.00
	87	10.26	8.40	6.26	17.34	6.50	9.02	15.75	7.94	18.52	100.00
	88	9.03	13.34	8.49	16.44	6.26	14.33	13.70	4.30	14.12	100.00
	89	8.95	11.40	9.14	9.67	4.93	12.38	14.56	6.30	22.65	100.00
	90	10.80	14.44	10.08	14.61	5.87	17.97	10.52	3.82	11.89	100.00
	91	8.30	16.90	10.99	11.32	4.65	30.87	7.37	2.28	7.30	100.00
MEAN		6.06	13.22	8.81	11.11	3.95	18.79	12.28	5.88	19.90	100.00
SED											
	84	22.77	12.68	10.77	23.99	7.99	21.81	0.00	0.00	0.00	100.00
	85	22.77	12.68	10.77	23.99	7.99	21.81	0.00	0.00	0.00	100.00
	86	19.70	11.77	10.62	29.46	6.36	22.11	0.00	0.00	0.00	100.00
	87	25.78	10.32	8.02	36.59	7.16	12.14	0.00	0.00	0.00	100.00
	88	17.82	14.19	10.44	34.51	7.11	15.93	0.00	0.00	0.00	100.00
	89	28.34	16.94	12.11	21.95	6.34	14.32	0.00	0.00	0.00	100.00
	90	23.71	14.15	10.43	29.68	6.58	15.46	0.00	0.00	0.00	100.00
	91	16.38	14.49	12.11	23.83	5.46	27.73	0.00	0.00	0.00	100.00
MEAN		9.40	18.09	15.46	23.00	3.92	30.12	0.00	0.00	0.00	100.00

Per Acre Load Contributed from Each Land Use in Shenandoah Basin (lb/ac)

Segment 190

	<-----	-----	Pervious	-----	-----	-----><	----Impervious	---->	Total
	FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Load
NH3									
84	0.07395	5.959	6.538	0.122	0.518	1.095	259.1135	1.08	0.825557
85	0.05978	2.487	2.14	0.09196	0.492	0.4179	253.8161	0.969	0.422789
86	0.03314	2.419	2.319	0.04404	0.126	0.2016	143.745	1.02	0.311099
87	0.05784	3.638	3.337	0.08217	0:387	0.4339	255.5246	1.05	0.503197
88	0.03436	2.058	1.965	0.04569	0.09389	0.1643	160.2792	0.992	0.285346
89	0.06837	6.849	5.234	0.09252	0.33	1.778	256.1574	1.13	0.83728
90	0.06026	4.991	5.194	0.08365	0.371	0.5075	233.8467	1.07	0.628957
91	0.05155	3.039	2.707	0.07117	0.248	0.5511	194.4052	1.02	0.430806
MEAN	0.054906	3.93	3.67925	0.07915	0.320736	0.643663	219.611	1.041375	0.530629
NO3									
84	1.67	17.09	15.04	6.4	7.77	4.943	64.77838	2.38	4.597364
85	1.66	16.33	13.99	6.01	6.97	3.018	63.45402	2.13	4.143449
86	1.02	10.67	7.747	3.26	3.39	1.877	35.93626	2.23	2.378793
87	1.42	16.27	12.24	5.12	6.16	3.762	63.88116	2.32	3.774117
88	0.966	17.12	14.29	3.44	3.57	2.292	40.0698	2.18	2.931977
89	1.5	25.24	22.08	6.09	6.96	4.533	64.03936	2.47	4.880428
90	1.64	19.89	17.95	5.65	6.47	3.554	58.46167	2.35	4.367126
91	1.42	14.2	11.92	4.5	5.03	3.002	48.6013	2.25	3.397152
MEAN	1.412	17.10125	14.40713	5.05875	5.79	3.372625	54.90275	2.28875	3.808801
ORGN									
84	0.64183	4.841	4.326	1.63611	3.5616	2.127	1554.681	3.39836	2.216107
85	0.44149	8.743	7.789	1.113	3.45401	2.138	1522.896	3.06446	2.239588
86	0.139496	1.02	0.7913	0.42294	0.66038	0.3088	862.4703	3.21286	0.726564
87	0.39326	5.521	4.571	0.94976	2.62297	1.911	1533.148	3.33529	1.867382
88	0.104251	0.4887	0.3173	0.40439	0.359499	0.07174	961.6753	3.13495	0.65788
89	0.45633	2.847	2.225	0.99799	2.03679	1.078	1536.945	3.55789	1.594748
90	0.368032	4.07	3.557	0.91266	2.44118	1.757	1403.08	3.37239	1.679327
91	0.322399	3.047	2.413	0.8162	1.52852	0.7028	1166.431	3.23883	1.264224
MEAN	0.358386	3.822213	3.2487	0.906631	2.083118	1.261792	1317.666	3.289379	1.530728
TN									
84	2.38578	27.89	25.91	8.15811	11.8496	8.165001	2267.243	6.85836	7.797283
85	2.16127	27.56	23.92	7.21496	10.91601	5.574	2220.891	6.16346	6.960608
86	1.192636	14.11	10.86	3.72698	4.17638	2.388	1257.769	6.46286	3.504311
87	1.8711	25.43	20.15	6.15193	9.16997	6.107	2235.841	6.70529	6.300593
88	1.104611	19.67	16.57	3.89008	4.023389	2.528	1402.443	6.30695	3.972853
89	2.0247	34.94	29.54	7.18051	9.32679	7.389	2241.378	7.15789	7.468742
90	2.068292	28.95	26.7	6.64631	9.28218	5.819	2046.159	6.79239	6.817943
91	1.793949	20.28	17.04	5.38737	6.80652	4.256	1701.045	6.50883	5.210565
MEAN	1.825292	24.85375	21.33625	6.044531	8.193854	5.27825	1921.596	6.619503	6.004112
PO4									
84	0.05055	2.391	2.729	0.0749	0.471	1.489	64.77838	0.481	0.482064
85	0.02645	2.195	1.614	0.05413	0.461	0.705	63.45402	0.433	0.308141
86	0.00938	1.519	1.347	0.02004	0.07753	0.4387	35.93626	0.454	0.193651
87	0.02937	2.451	2.045	0.04623	0.346	0.9761	63.88116	0.471	0.360754
88	0.005542	1.714	1.516	0.01921	0.03386	0.2528	40.0698	0.443	0.180628
89	0.03351	3.648	3.171	0.04997	0.261	1.699	64.03936	0.503	0.528813
90	0.02245	3.323	2.932	0.04503	0.319	0.9746	58.46167	0.477	0.417551
91	0.02436	1.729	1.558	0.03794	0.194	1.182	48.6013	0.458	0.322861
MEAN	0.025202	2.37125	2.114	0.043431	0.270424	0.96465	54.90275	0.465	0.349308
ORGP									
84	0.09169	1.342	1.154	0.23373	0.5088	0.5728	259.1135	0.48548	0.405594
85	0.06307	2.445	2.097	0.159	0.49343	0.5998	253.8161	0.43778	0.446682
86	0.019928	0.2823	0.2111	0.06042	0.09434	0.08567	143.745	0.45898	0.125145
87	0.05618	1.534	1.222	0.13568	0.37471	0.5226	255.5246	0.47647	0.357039
88	0.014893	0.1359	0.08493	0.05777	0.051357	0.01926	160.2792	0.44785	0.107852
89	0.06519	0.7911	0.5962	0.14257	0.29097	0.2994	256.1574	0.50827	0.282817
90	0.052576	1.129	0.9516	0.13038	0.34874	0.4902	233.8467	0.48177	0.316878
91	0.046057	0.8444	0.6442	0.1166	0.21836	0.1917	194.4052	0.46269	0.227174
MEAN	0.051198	1.062963	0.870129	0.129519	0.297588	0.347679	219.611	0.469911	0.283648

Segment 190

	FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Total Load
	<-----	-----	Pervious	-----	-----	---->	<--Impervious	--->	
TP									
84	0.14224	3.733	3.883	0.30863	0.9798	2.061	453.4486	0.96648	0.940211
85	0.08952	4.639	3.711	0.21313	0.95443	1.305	444.1781	0.87078	0.806397
86	0.029308	1.801	1.558	0.08046	0.17187	0.5244	251.5538	0.91298	0.347996
87	0.08555	3.985	3.267	0.18191	0.72071	1.499	447.1681	0.94747	0.769749
88	0.020435	1.85	1.601	0.07698	0.085217	0.2721	280.4886	0.89085	0.321058
89	0.0987	4.439	3.767	0.19254	0.55197	1.998	448.2755	1.01127	0.863618
90	0.075026	4.452	3.884	0.17541	0.66774	1.465	409.2317	0.95877	0.781989
91	0.070417	2.574	2.202	0.15454	0.41236	1.374	340.2091	0.92069	0.589575
MEAN	0.076399	3.434125	2.984125	0.17295	0.568012	1.312312	384.3192	0.934911	0.677574
BOD									
84	5.19	108.3	65.10001	13.23	28.8	39.9	4534.486	27.48	20.43703
85	3.57	240.9	142.2	9.0	27.93	40.5	4441.781	24.78	25.49944
86	1.128	19.74	11.46	3.42	5.34	6.210001	2515.538	25.98	5.020105
87	3.18	140.7	79.8	7.68	21.21	36.9	4471.681	26.97	18.75764
88	0.843	12.96	8.820001	3.27	2.907	2.466	2804.886	25.35	4.04411
89	3.69	75.3	46.2	8.070001	16.47	21.99	4482.755	28.77	13.85227
90	2.976	113.1	68.10001	7.380001	19.74	33.6	4092.317	27.27	16.73508
91	2.607	74.7	38.7	6.6	12.36	13.95	3402.091	26.19	10.84844
MEAN	2.898	98.2125	57.5475	7.33125	16.84463	24.4395	3843.192	26.59875	14.39926
SED									
84	0.161	1.39	1.01	0.377	0.291	0.764	0.0	0.0	0.356806
85	0.07501	2.37	1.72	0.247	0.285	0.751	0.0	0.0	0.341761
86	0.03091	0.277	0.175	0.0886	0.04231	0.111	0.0	0.0	0.066071
87	0.07149	1.56	1.05	0.208	0.211	0.682	0.0	0.0	0.265757
88	0.01559	0.146	0.07836	0.08145	0.01251	0.03172	0.0	0.0	0.037465
89	0.08934	0.807	0.517	0.213	0.149	0.391	0.0	0.0	0.192556
90	0.06207	1.12	0.806	0.197	0.191	0.619	0.0	0.0	0.227513
91	0.06088	0.862	0.553	0.18	0.115	0.255	0.0	0.0	0.155599
MEAN	0.070786	1.0665	0.73867	0.199006	0.162103	0.45059	0.0	0.0	0.205441

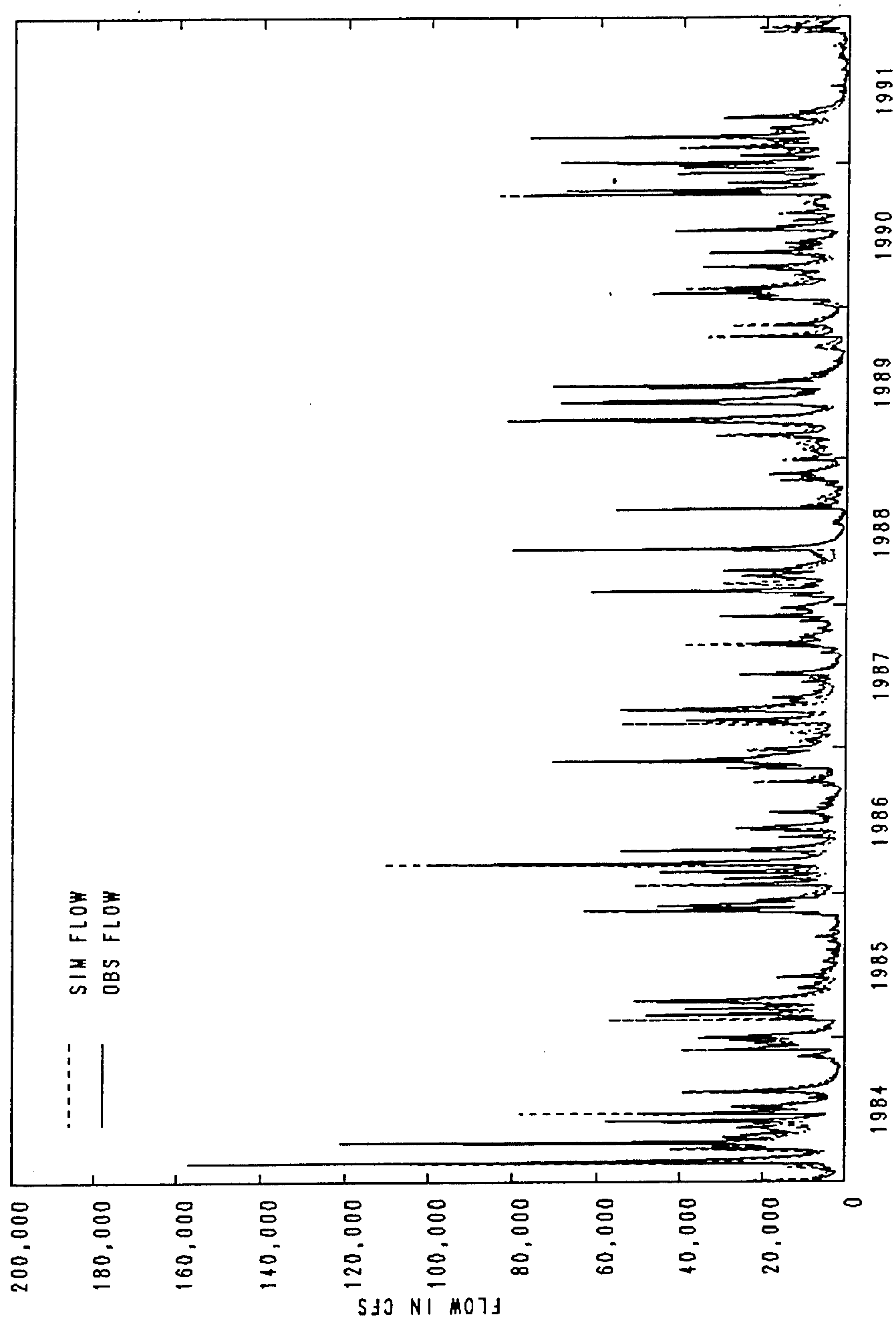
Segment 200

	<------------------------	----------	Pervious	----------------------	----------	---><----	Impervious	---->	
	FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Total Load
NH3									
84	0.05779	3.9	3.735	0.118	0.57	0.8697	228.8566	1.38	0.518301
85	0.04321	1.907	1.613	0.06504	0.206	0.1763	203.4	1.28	0.263629
86	0.02965	2.931	2.716	0.0435	0.13	0.2751	127.8527	1.32	0.302379
87	0.03721	3.415	2.584	0.06537	0.211	0.252	212.675	1.37	0.349625
88	0.02937	1.841	1.751	0.0371	0.121	0.1399	141.7562	1.26	0.224479
89	0.03945	3.072	2.567	0.06877	0.232	0.5771	194.6222	1.45	0.372315
90	0.04685	3.998	4.945	0.08391	0.293	0.2912	222.158	1.41	0.475716
91	0.03502	1.729	1.606	0.04402	0.119	0.3357	135.7537	1.33	0.240112
MEAN	0.039819	2.849125	2.689625	0.065714	0.23525	0.364625	183.3843	1.35	0.34332
NO3									
84	1.48	14.99	12.58	6.03	7.57	4.648	57.21416	2.54	4.02192
85	1.31	10.81	9.488	4.92	4.99	2.003	50.85	2.35	3.0238
86	0.927	8.632	6.323	3.12	3.31	1.682	31.96318	2.41	2.090789
87	0.986	12.33	8.809	3.98	4.39	2.686	53.16876	2.5	2.687831
88	0.778	14.76	12.73	2.94	3.26	1.95	35.43906	2.3	2.39865
89	0.912	19.14	16.97	4.15	4.71	3.338	48.65554	2.65	3.263272
90	1.31	13.55	14.01	5.12	5.59	3.063	55.5395	2.58	3.461941
91	1.12	8.001	5.59	3.49	3.58	2.263	33.93842	2.44	2.311934
MEAN	1.102875	12.77663	10.8125	4.21875	4.675	2.704125	45.84608	2.47125	2.907517
ORGN									
84	0.52311	5.729	4.267	1.60272	4.0439	2.017	1373.14	3.31674	1.888529
85	0.228165	1.607	1.266	0.65296	1.19091	0.5983	1220.4	3.07188	0.933074
86	0.111671	0.7419	0.498	0.41923	0.7049	0.1667	767.1164	3.16092	0.546994
87	0.188097	1.998	1.289	0.76055	1.2985	0.4436	1276.05	3.27593	0.959265
88	0.116865	1.166	0.7228	0.280476	0.64183	0.1917	850.5375	3.01252	0.560918
89	0.267862	2.503	1.595	0.80507	1.45061	0.5332	1167.733	3.47256	1.021647
90	0.335384	4.138	3.017	1.01654	1.87355	1.601	1332.948	3.37239	1.390915
91	0.089782	1.637	1.228	0.365806	0.58247	0.5522	814.5221	3.1906	0.623856
MEAN	0.232617	2.439987	1.73535	0.737919	1.473334	0.762962	1100.306	3.234192	0.99065
TN									
84	2.0609	24.62	20.58	7.75072	12.1839	7.535	2002.496	7.23674	6.540712
85	1.581375	14.32	12.37	5.638	6.38691	2.778	1779.75	6.70188	4.320075
86	1.068321	12.3	9.537	3.58273	4.1449	2.123	1118.711	6.89092	3.002506
87	1.211307	17.74	12.68	4.80592	5.8995	3.382	1860.907	7.14593	4.100669
88	0.924235	17.76	15.2	3.257576	4.02283	2.281	1240.367	6.57252	3.253017
89	1.219312	24.71	21.13	5.02384	6.39261	4.448	1702.944	7.572559	4.752223
90	1.692234	21.68	21.97	6.22045	7.75655	4.955	1943.882	7.36239	5.437018
91	1.244802	11.37	8.425	3.899826	4.28147	3.15	1187.845	6.9606	3.242349
MEAN	1.375311	18.0625	15.2365	5.022383	6.383584	3.8315	1604.613	7.055442	4.331071
PO4									
84	0.01275	1.565	1.612	0.07378	0.545	1.084	57.21416	0.472	0.294262
85	0.004142	1.614	1.25	0.03355	0.15	0.3016	50.85	0.437	0.162422
86	0.002498	1.497	1.253	0.01954	0.08389	0.5273	31.96318	0.449	0.169414
87	0.003925	1.924	1.607	0.0365	0.167	0.6235	53.16876	0.466	0.220478
88	0.002625	1.743	1.638	0.01425	0.07615	0.247	35.43906	0.428	0.160325
89	0.006005	2.582	2.399	0.03844	0.187	0.8657	48.65554	0.494	0.294695
90	0.007046	2.462	2.366	0.04843	0.244	0.7757	55.5395	0.479	0.288802
91	0.001943	1.107	0.9238	0.01823	0.06614	0.8538	33.93842	0.454	0.180046
MEAN	0.005117	1.81175	1.6311	0.03534	0.189898	0.659825	45.84608	0.459875	0.221306
ORGP									
84	0.07473	1.61	1.138	0.22896	0.5777	0.5464	228.8566	0.47382	0.348405
85	0.032595	0.4525	0.3392	0.09328	0.17013	0.1655	203.4	0.43884	0.163035
86	0.015953	0.2056	0.1333	0.05989	0.1007	0.0456	127.8527	0.45156	0.091365
87	0.026871	0.564	0.3445	0.10865	0.1855	0.1198	212.675	0.46799	0.166286
88	0.016695	0.3305	0.1942	0.040068	0.09169	0.05159	141.7562	0.43036	0.097044
89	0.038266	0.7043	0.426	0.11501	0.20723	0.1462	194.6222	0.49608	0.179011
90	0.047912	1.171	0.8096	0.14522	0.26765	0.4432	222.158	0.48177	0.261161
91	0.012826	0.4608	0.3279	0.052258	0.08321	0.1478	135.7537	0.4558	0.114429
MEAN	0.033231	0.687338	0.464087	0.105417	0.210476	0.208261	183.3843	0.462027	0.177592

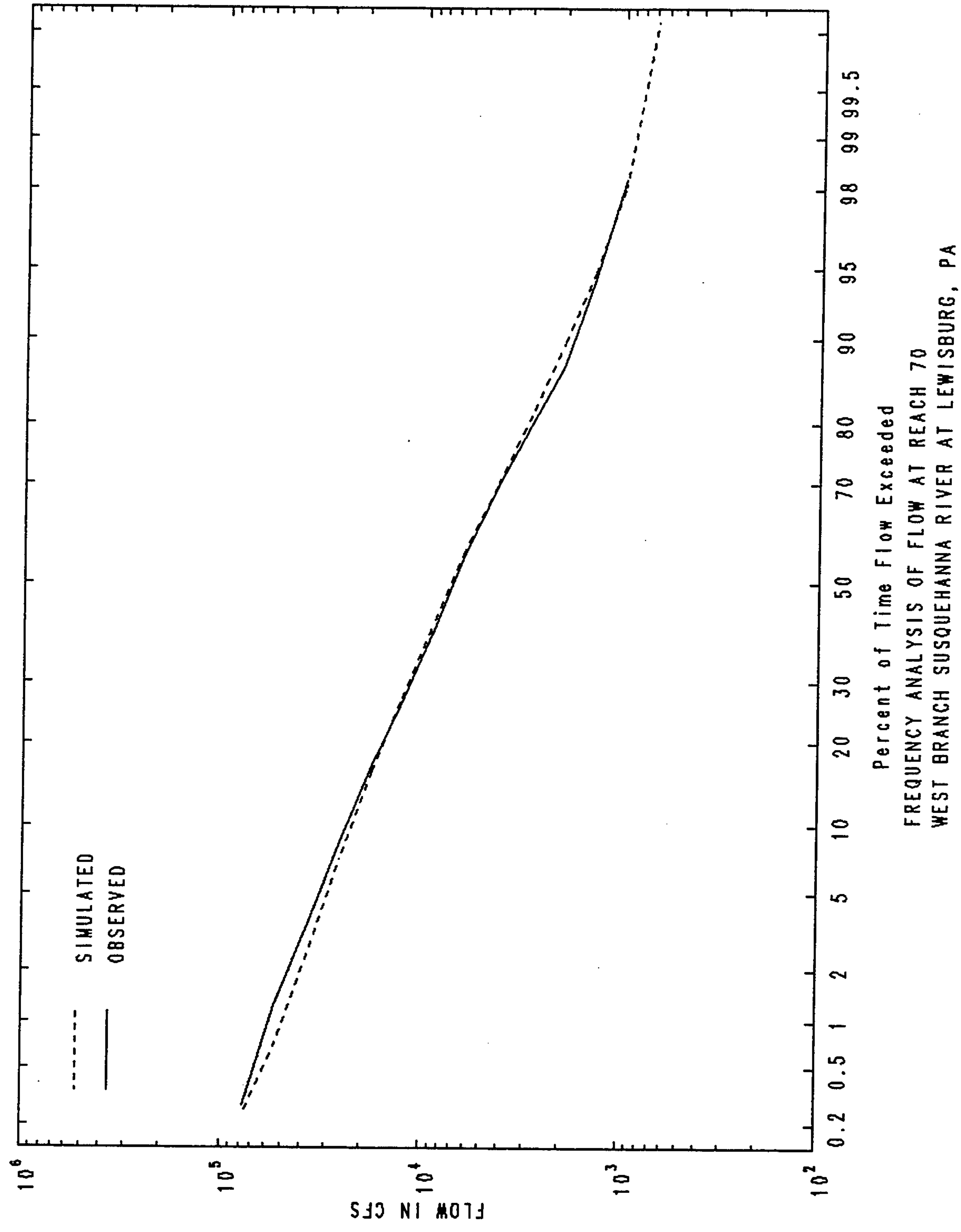
Segment 200

	FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Total Load
	<----------	----------	Pervious	----------	----------	---------->	<----Impervious	---->	
TP									
84	0.08748	3.175	2.75	0.30274	1.1227	1.631	400.4991	0.94582	0.680056
85	0.036737	2.067	1.59	0.12683	0.32013	0.4672	355.95	0.87584	0.358685
86	0.018451	1.703	1.386	0.07943	0.18459	0.5729	223.7423	0.90056	0.281631
87	0.030796	2.488	1.951	0.14515	0.3525	0.7433	372.1813	0.93399	0.421432
88	0.01932	2.073	1.832	0.054318	0.16784	0.2986	248.0734	0.85836	0.28047
89	0.044271	3.286	2.825	0.15345	0.39423	1.012	340.5888	0.99008	0.505452
90	0.054958	3.633	3.176	0.19365	0.51165	1.219	388.7765	0.96077	0.586223
91	0.014769	1.567	1.252	0.070488	0.14935	1.002	237.5689	0.9098	0.316649
MEAN	0.038348	2.499	2.09525	0.140757	0.400374	0.86825	320.9225	0.921903	0.428825
BOD									
84	4.23	130.5	59.1	12.96	32.7	51.9	4004.991	26.82	19.84063
85	1.845	41.7	22.77	5.28	9.63	18.84	3559.5	24.84	8.18682
86	0.903	14.7	7.68	3.39	5.7	3.99	2237.423	25.56	3.774508
87	1.521	44.7	19.95	6.15	10.5	12.12	3721.813	26.49	7.614143
88	0.945	23.94	13.47	2.268	5.19	6.57	2480.734	24.36	4.299249
89	2.166	57.6	28.23	6.510001	11.73	18.12	3405.888	28.08	9.306361
90	2.712	109.8	50.1	8.22	15.15	50.7	3887.765	27.27	15.94561
91	0.726	31.5	14.73	2.958	4.71	11.31	2375.689	25.8	5.052822
MEAN	1.881	56.805	27.00375	5.967	11.91375	21.69375	3209.225	26.1525	9.252518
SED									
84	0.15	1.66	0.99	0.351	0.524	0.722	0.0	0.0	0.346786
85	0.03882	0.461	0.292	0.129	0.125	0.219	0.0	0.0	0.103781
86	0.02627	0.209	0.114	0.0828	0.07266	0.06218	0.0	0.0	0.053642
87	0.03697	0.585	0.302	0.159	0.147	0.166	0.0	0.0	0.109187
88	0.02868	0.341	0.171	0.04936	0.06394	0.07286	0.0	0.0	0.05329
89	0.0604	0.717	0.371	0.168	0.167	0.198	0.0	0.0	0.134163
90	0.06652	1.17	0.686	0.215	0.221	0.566	0.0	0.0	0.213807
91	0.01242	0.475	0.285	0.06751	0.05166	0.2	0.0	0.0	0.069549
MEAN	0.05251	0.70225	0.401375	0.152709	0.171532	0.275755	0.0	0.0	0.135526

Appendix B
West Branch Susquehanna Model Segments Results



SIMULATED AND OBSERVED FLOW AT REACH 70
WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA


SIMULATED
OBSERVED
FLOW IN CFS
10^2
10^3
10^4
10^5
10^6
0.2
0.5
1
2
5
10
20
30
50
70
80
90
95
98
99
99.5
Percent of Time Flow Exceeded
FREQUENCY ANALYSIS OF FLOW AT REACH 70
WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA

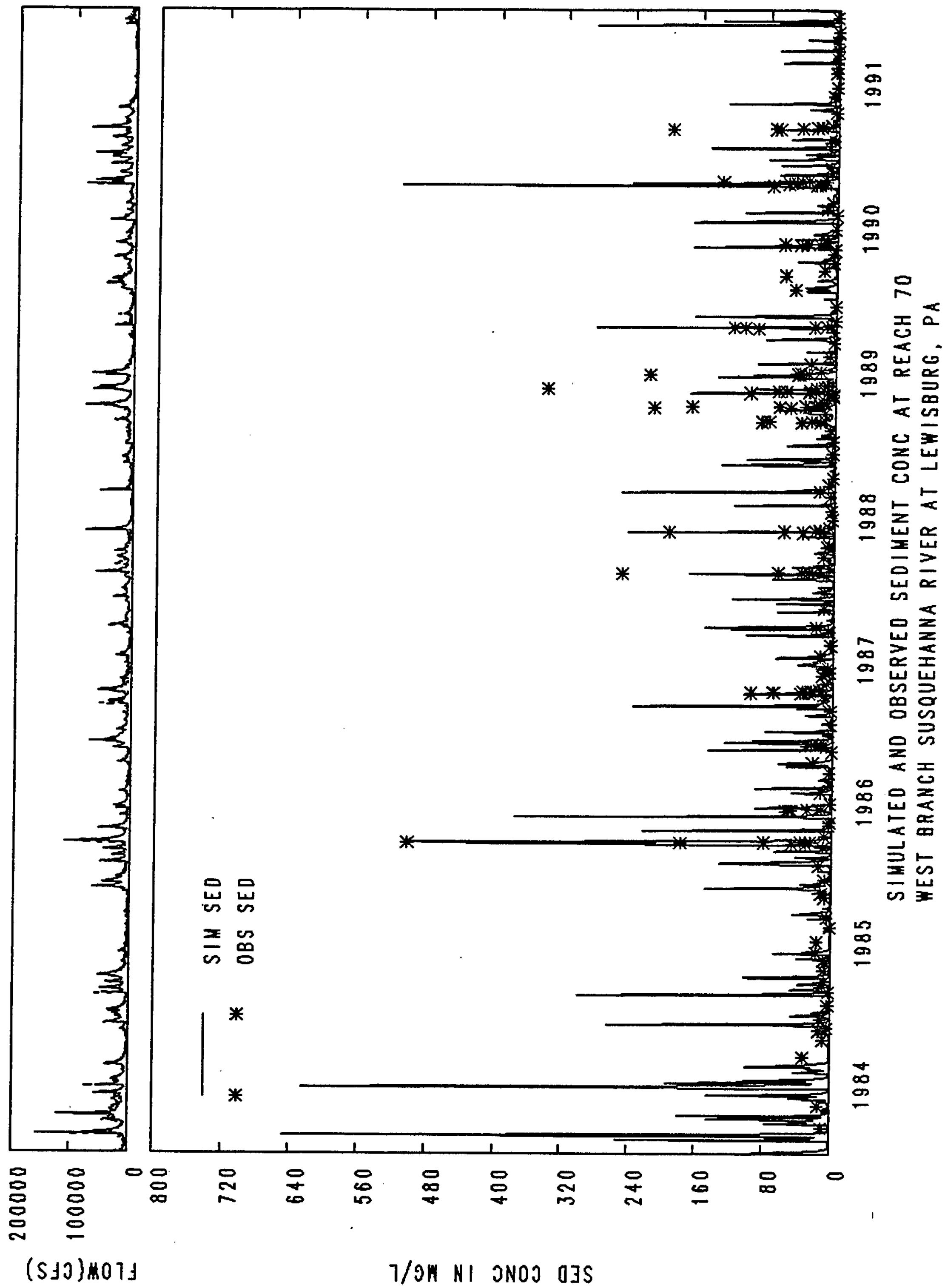
CHESAPEAKE BAY WATERSHED HYDROLOGIC CALIBRATION
COMPARISON OF ANNUAL TOTAL OBSERVED vs SIMULATED FLOW

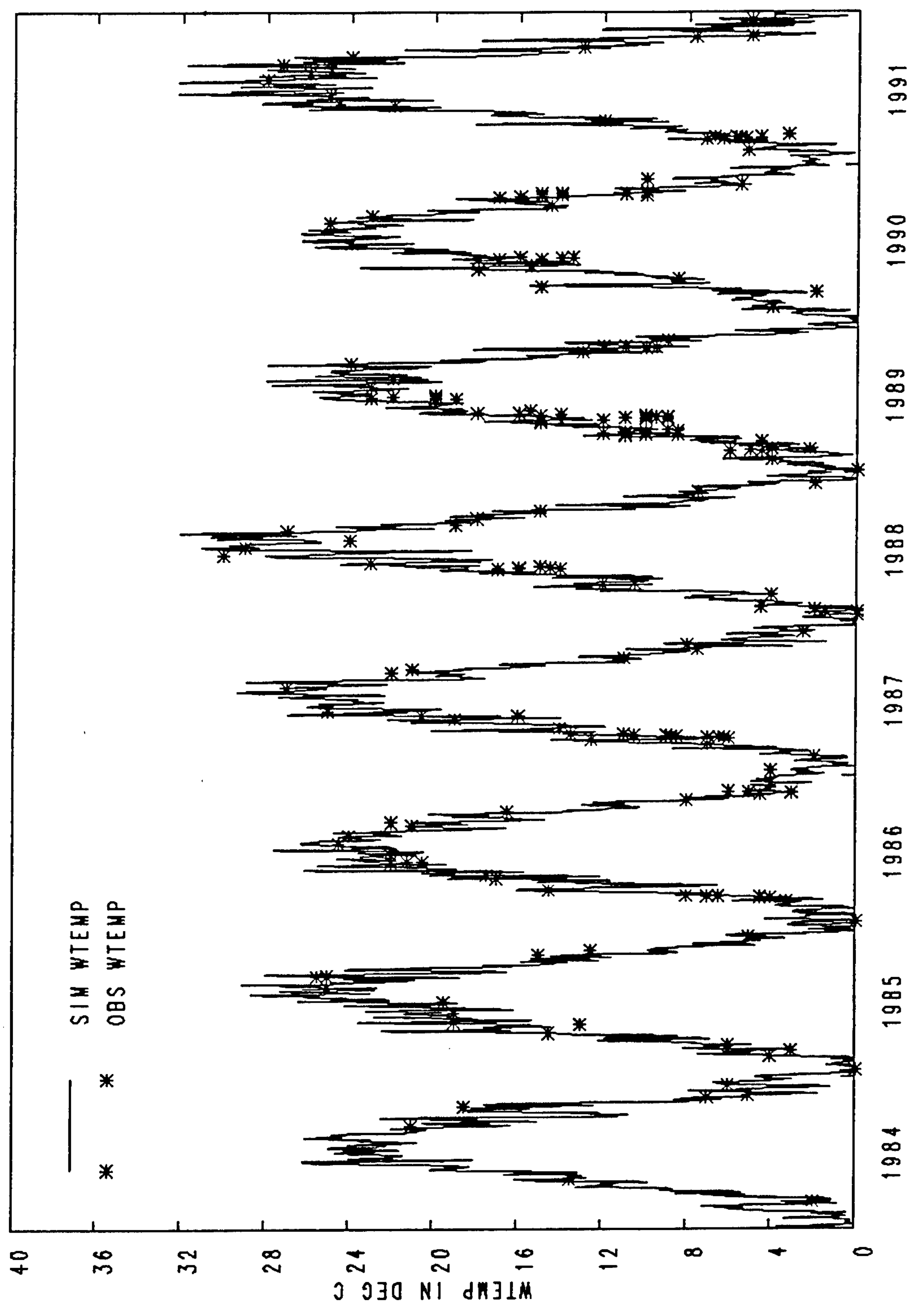
PHASE III

WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA(SEGMENT 70)

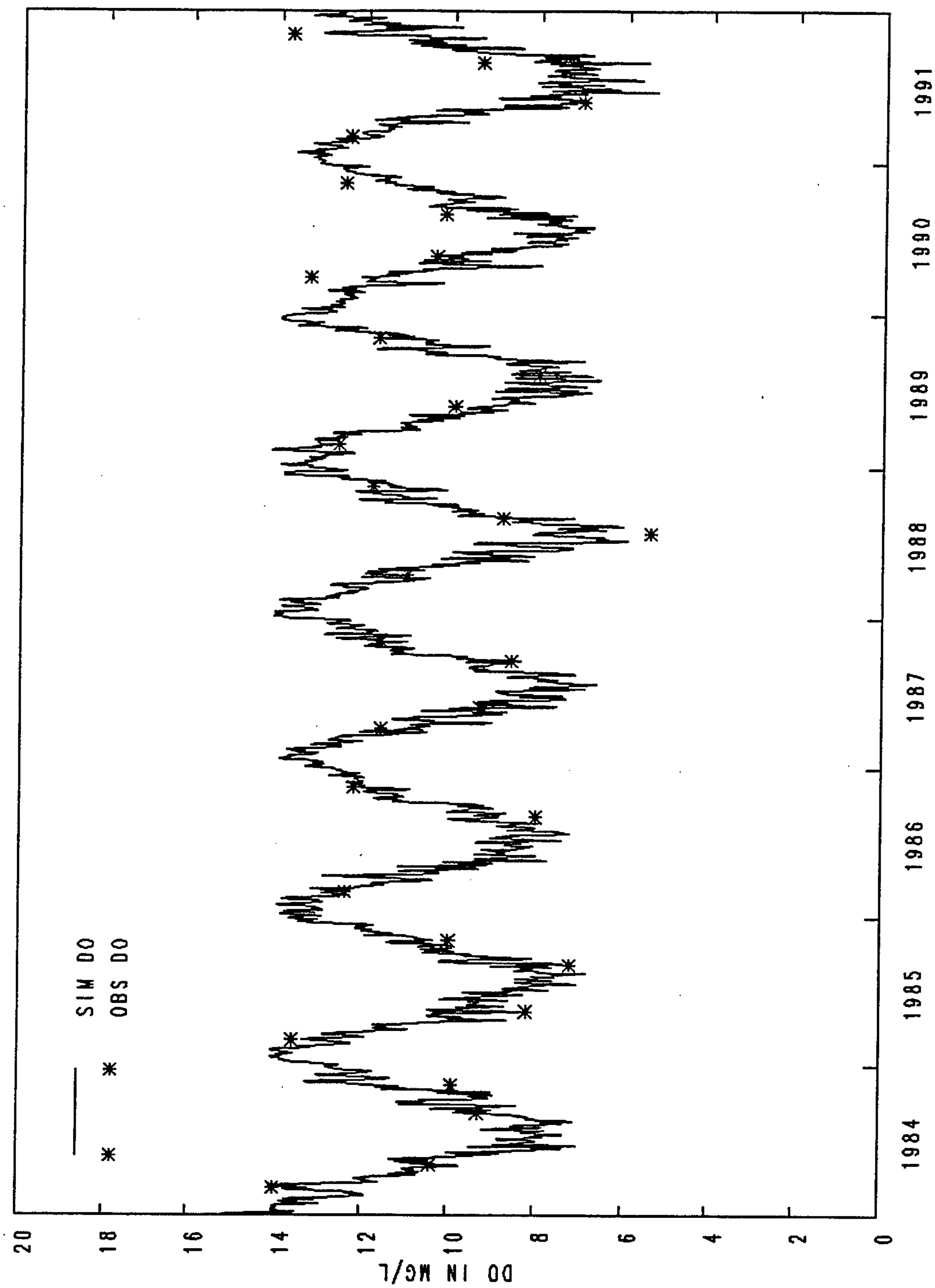
YEAR	OBSERVED* FLOW (in)	SIMULATED** FLOW (in)
1984	28.32	26.28
1985	18.82	17.22
1986	23.38	22.23
1987	17.99	17.58
1988	14.89	15.19
1989	20.89	20.93
1990	26.93	25.94
1991	14.89	15.84
MEAN	20.76	20.15

* - Observed Flow at WB Susquehanna River at Lewisburg, PA
** - Simulated Outflow from RCH 70

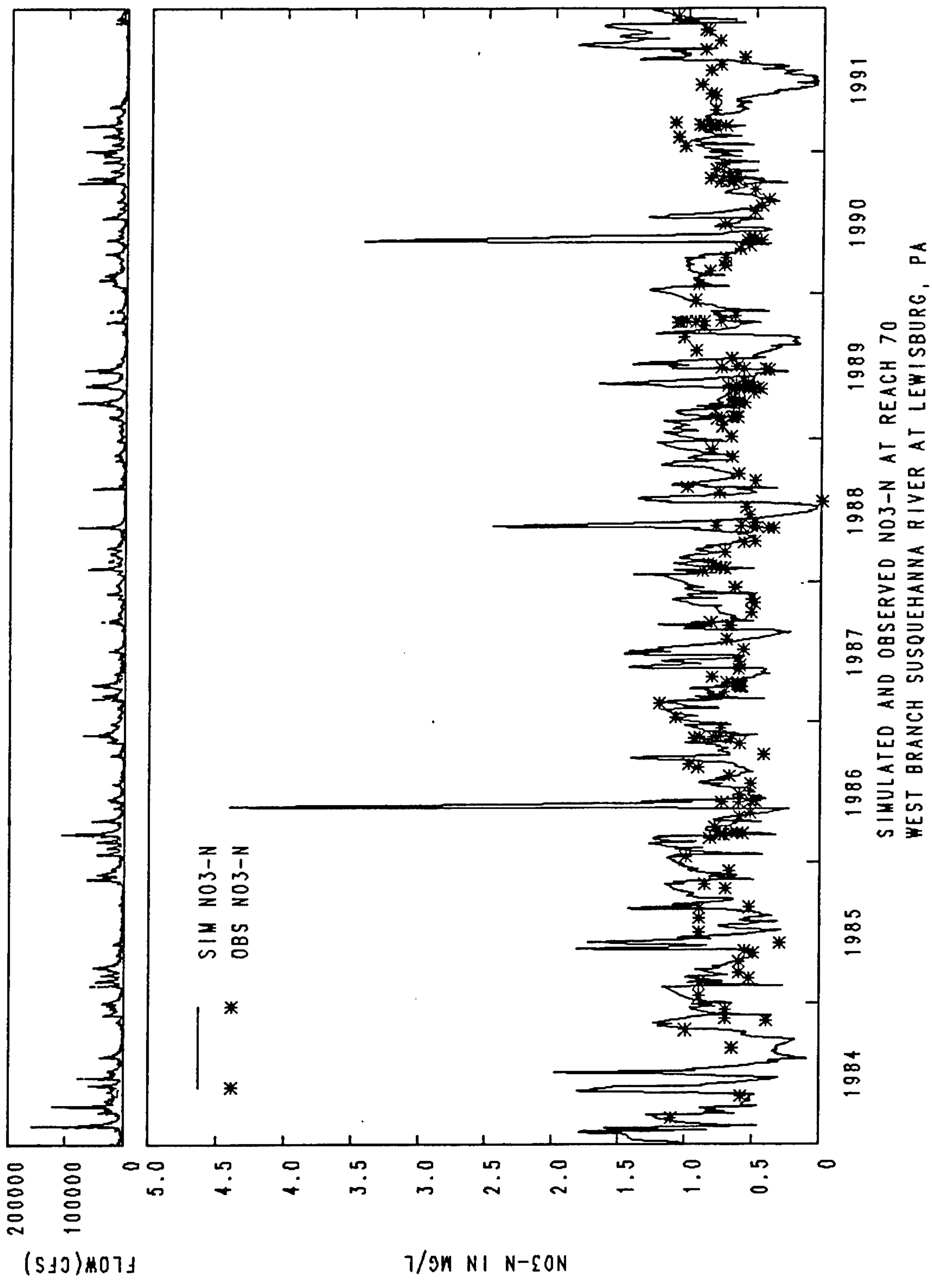

SIMULATED AND OBSERVED SEDIMENT CONC AT REACH 70
WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA
SIM SED
OBS SED
FLOW(CFS)
200000
100000
0
SED CONC IN MG/L
800
720
640
560
480
400
320
240
160
80
0
1984
1985
1986
1987
1988
1989
1990
1991

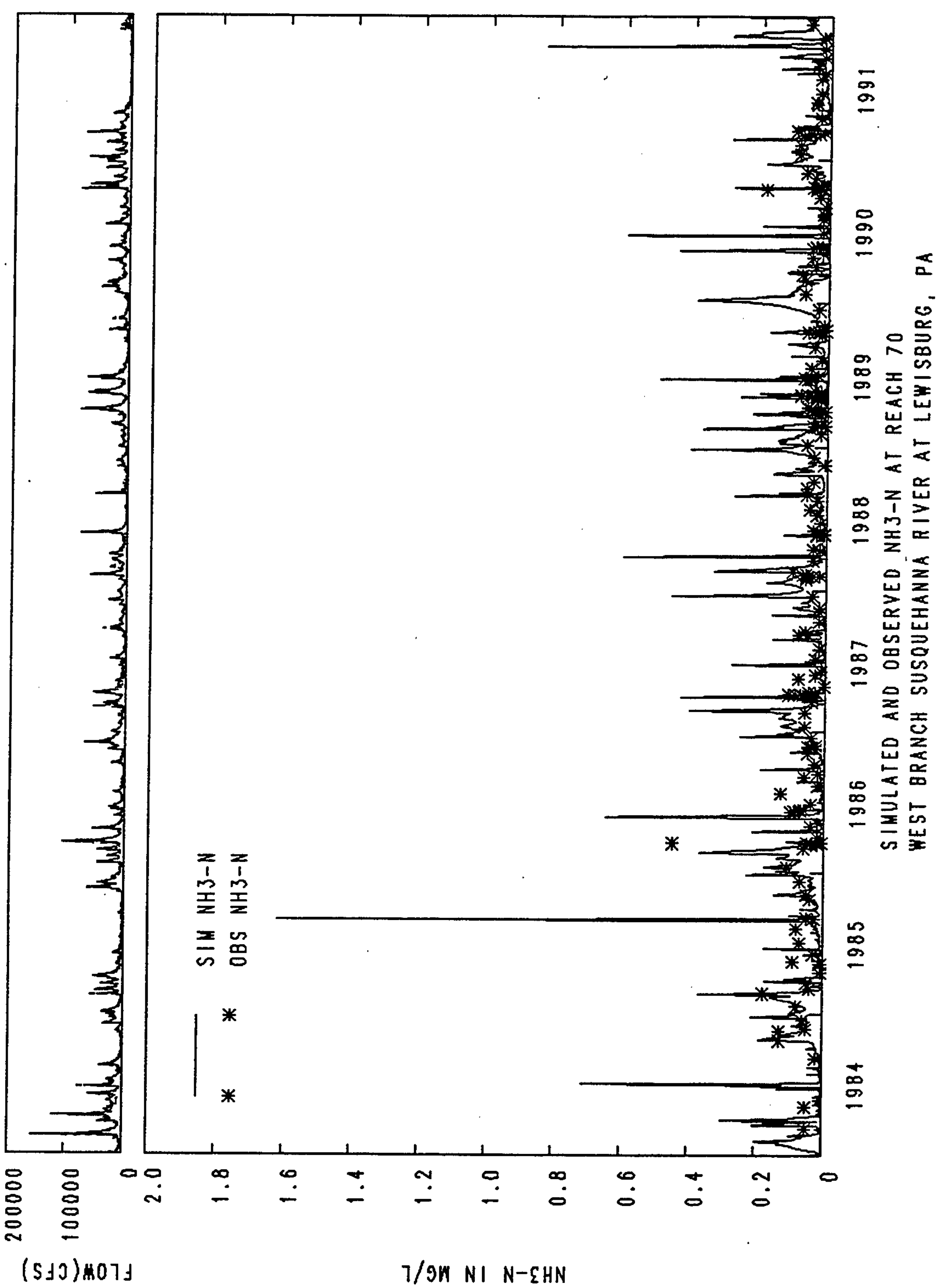


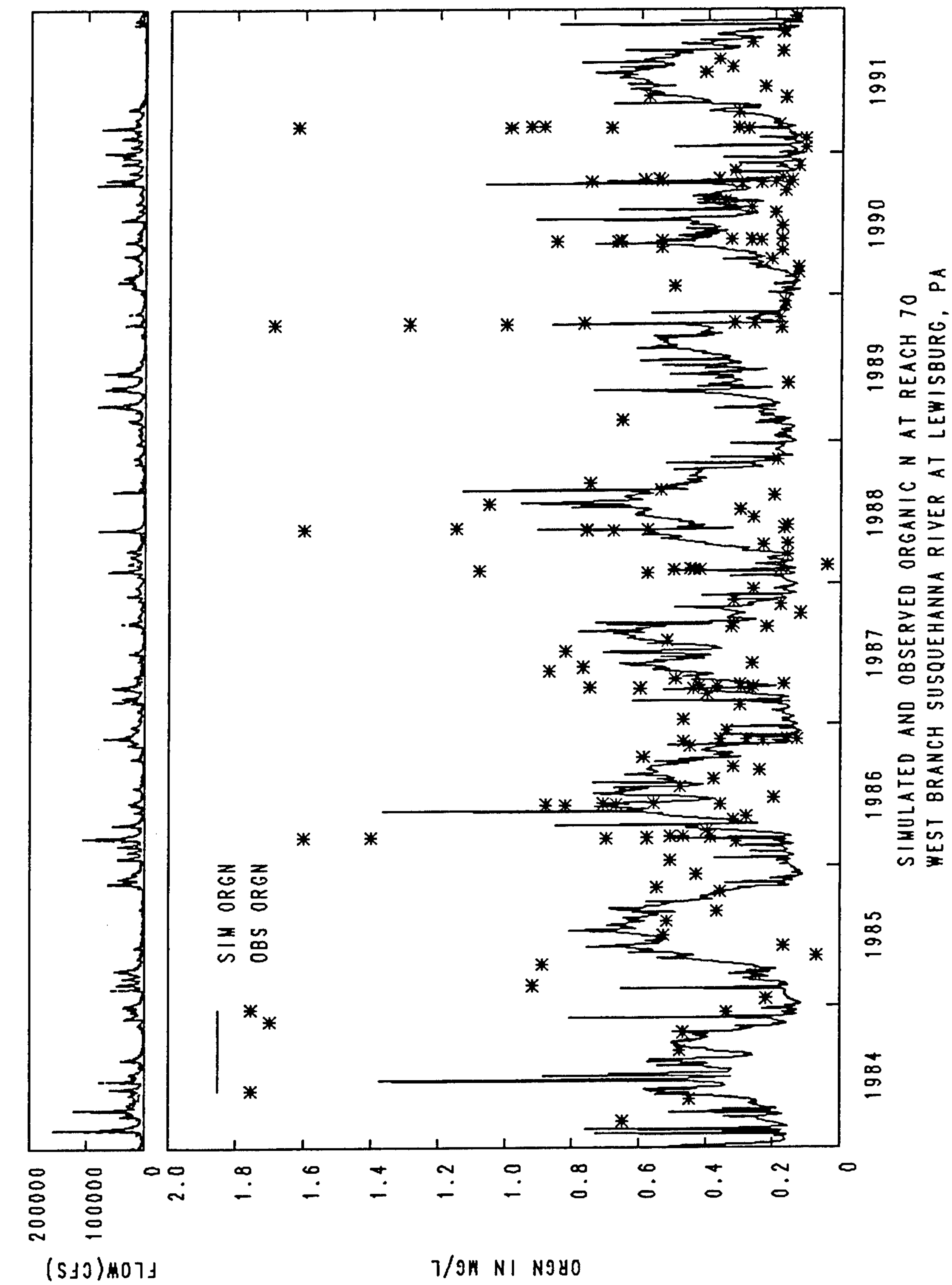
SIMULATED AND OBSERVED WATER TEMPERATURE AT REACH 70
WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA

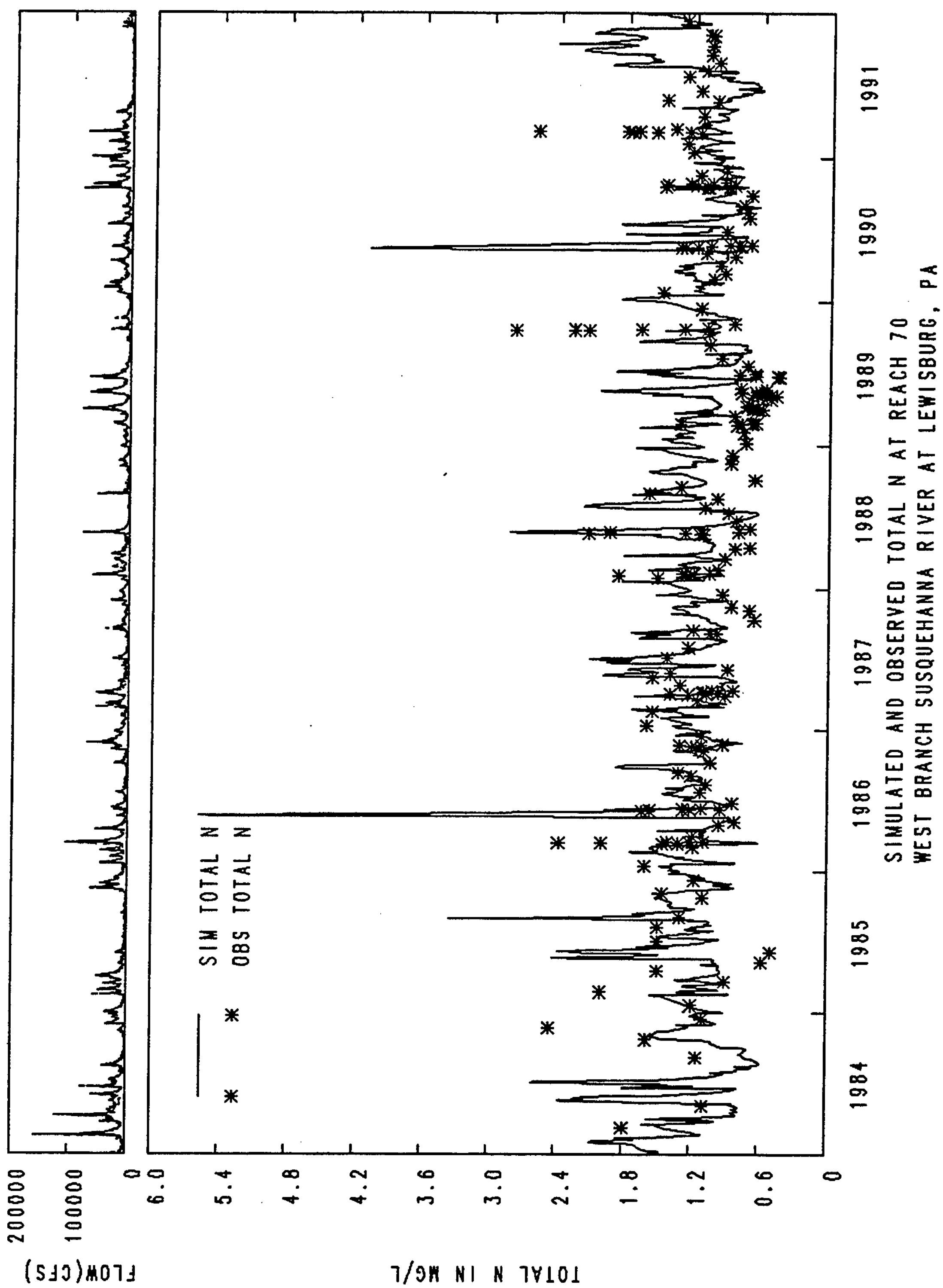


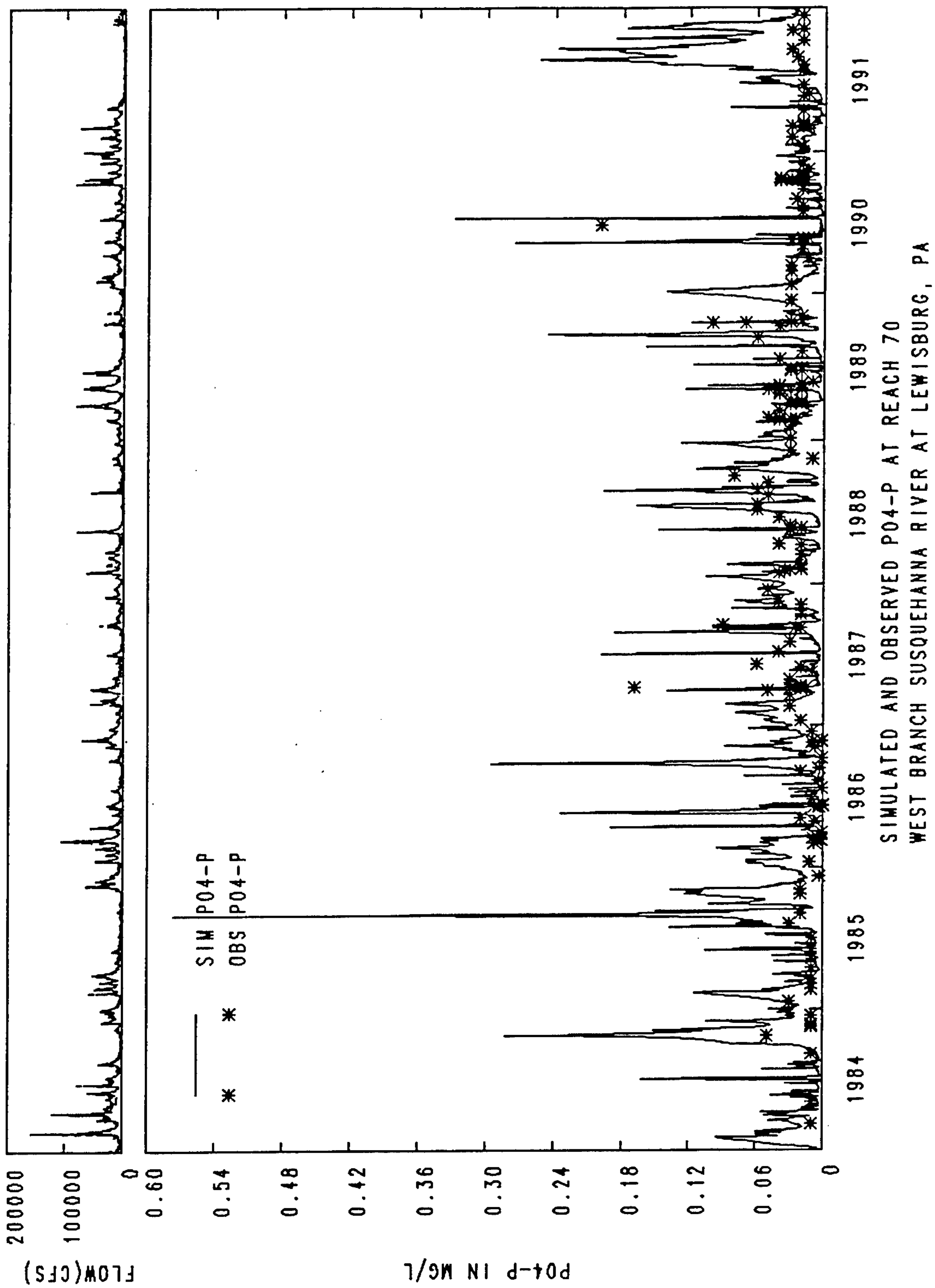
SIMULATED AND OBSERVED DO AT REACH 70
WST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA

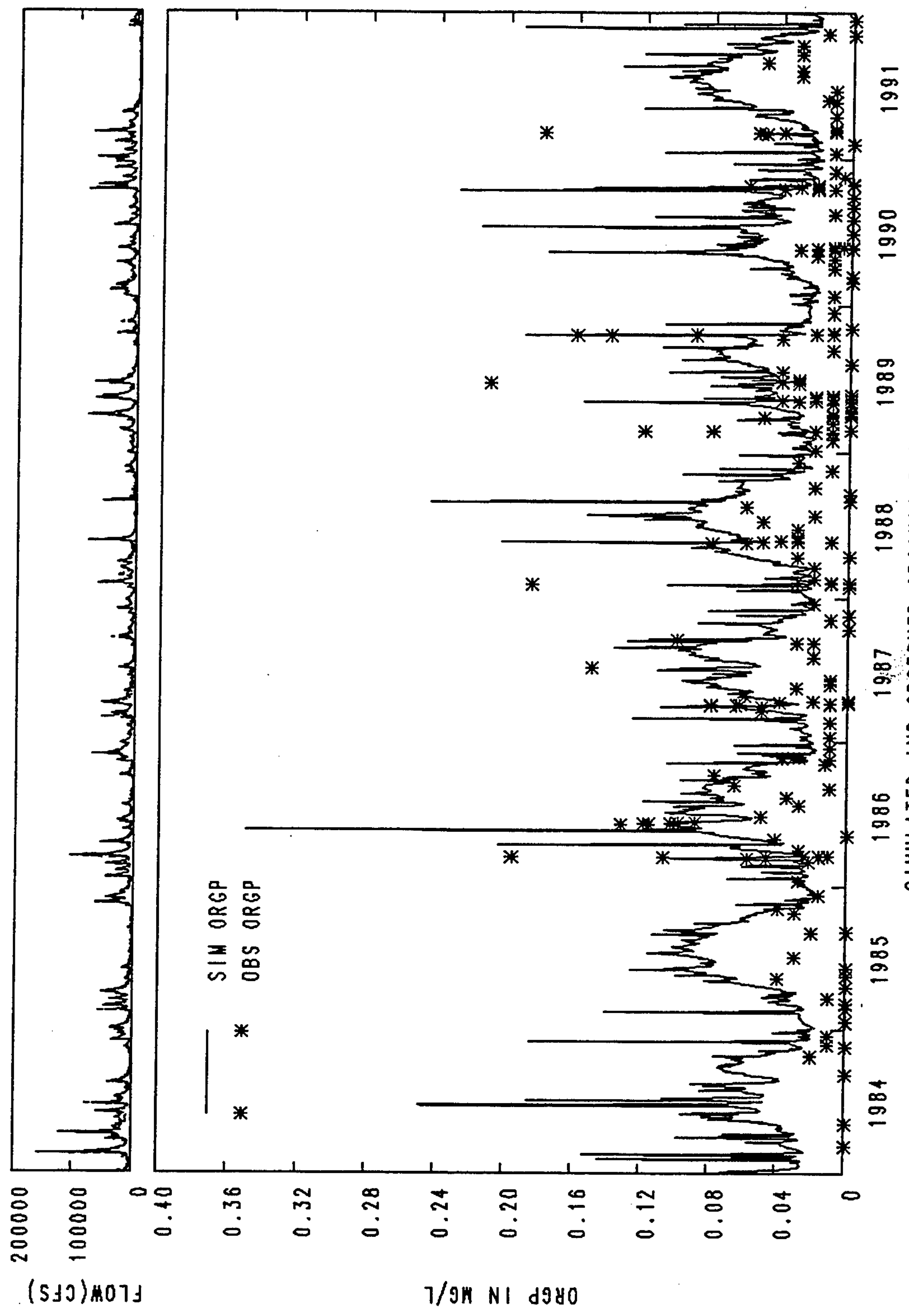

FLOW(CFS)
200000
100000
0
NO3-N IN MG/L
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
SIM NO3-N
OBS NO3-N
1984
1985
1986
1987
1988
1989
1990
1991
SIMULATED AND OBSERVED NO3-N AT REACH 70
WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA


FLOW(CFS)
200000
100000
0
NH3-N IN MG/L
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
SIM NH3-N
OBS NH3-N
1984
1985
1986
1987
1988
1989
1990
1991
SIMULATED AND OBSERVED NH3-N AT REACH 70
WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA

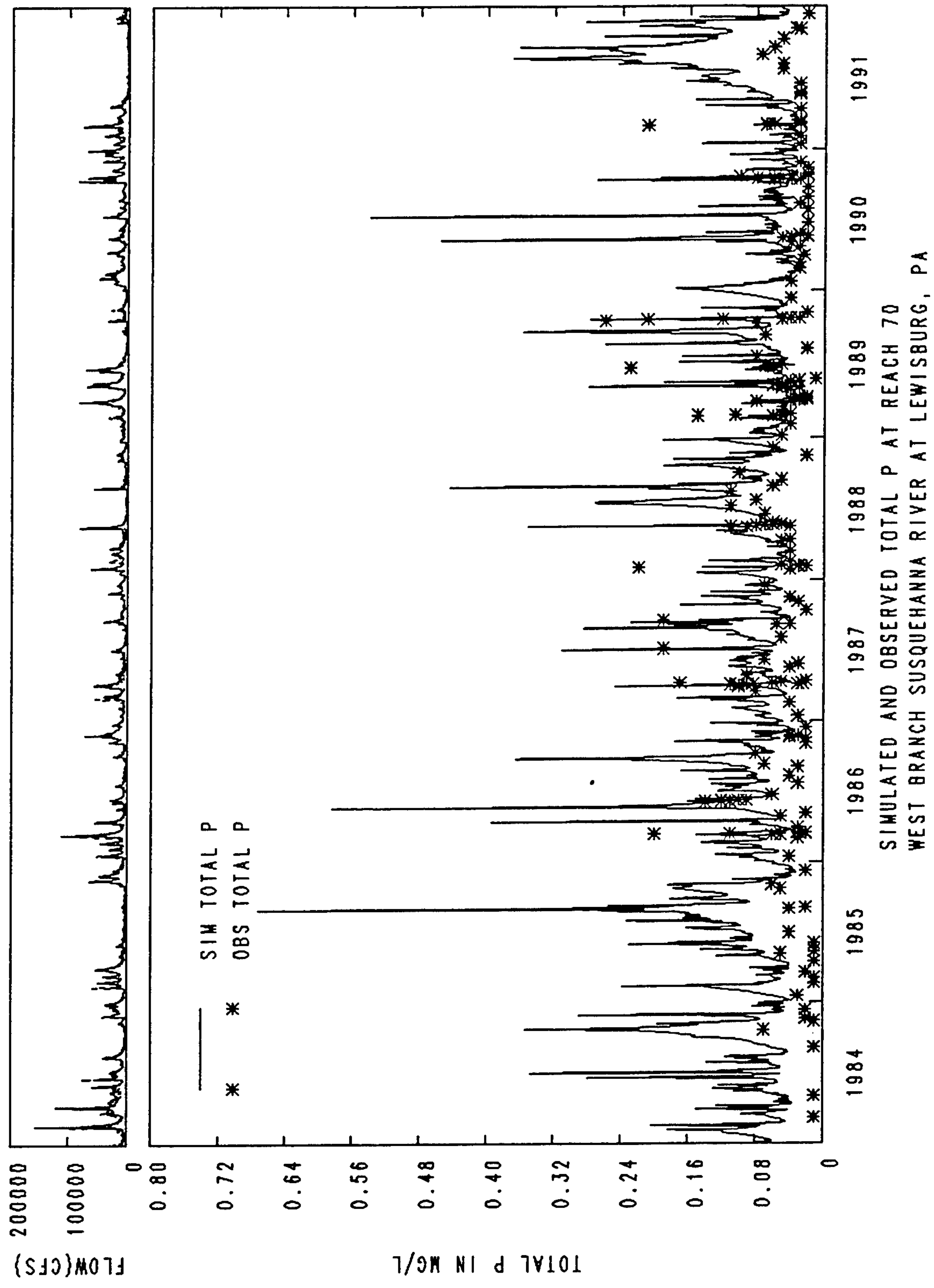

FLOW(CFS)
200000
100000
0
ORGN IN MG/L
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
SIM ORGN
OBS ORGN
1984
1985
1986
1987
1988
1989
1990
1991
SIMULATED AND OBSERVED ORGANIC N AT REACH 70
WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA

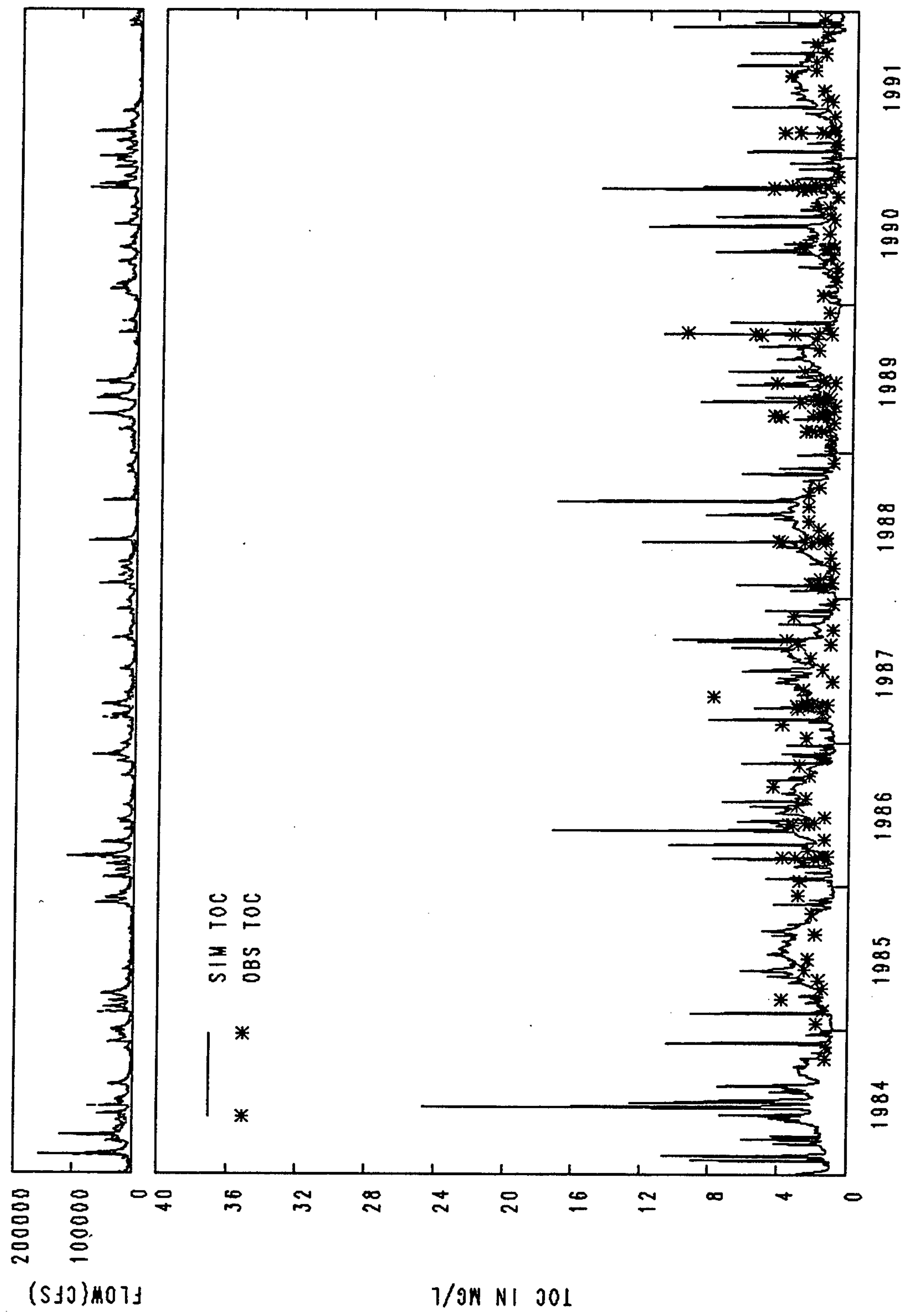

SIM TOTAL N
OBS TOTAL N
FLOW(CFS)
200000
100000
0
TOTAL N IN MG/L
6.0
5.4
4.8
4.2
3.6
3.0
2.4
1.8
1.2
0.6
0
1984
1985
1986
1987
1988
1989
1990
1991
SIMULATED AND OBSERVED TOTAL N AT REACH 70
WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA


SIMULATED AND OBSERVED PO4-P AT REACH 70
WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA
FLOW(CFS)
PO4-P IN MG/L
SIM PO4-P
OBS PO4-P
200000
100000
0
0.60
0.54
0.48
0.42
0.36
0.30
0.24
0.18
0.12
0.06
0
1984
1985
1986
1987
1988
1989
1990
1991

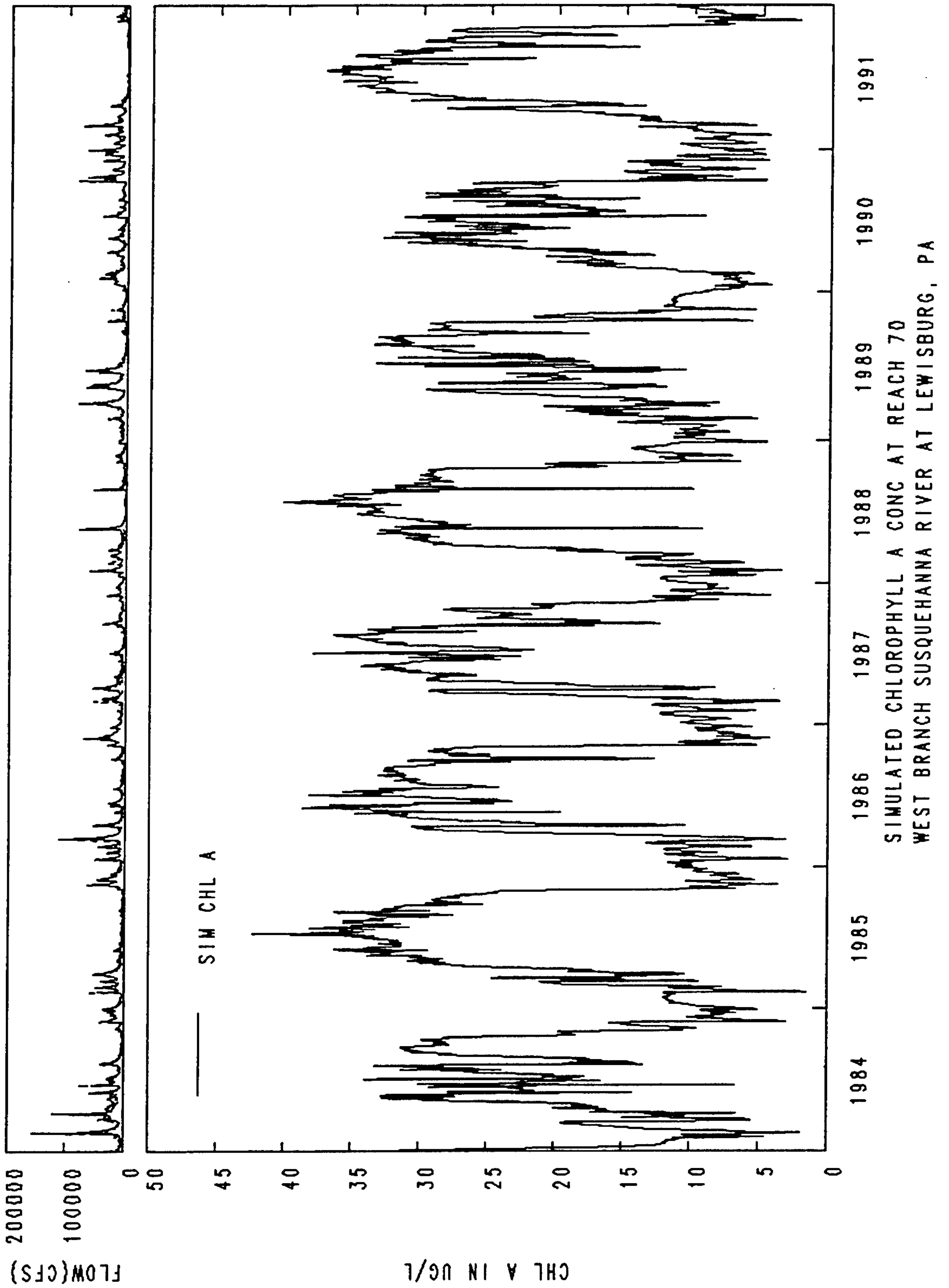


SIMULATED AND OBSERVED ORGANIC P AT REACH 70
WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA

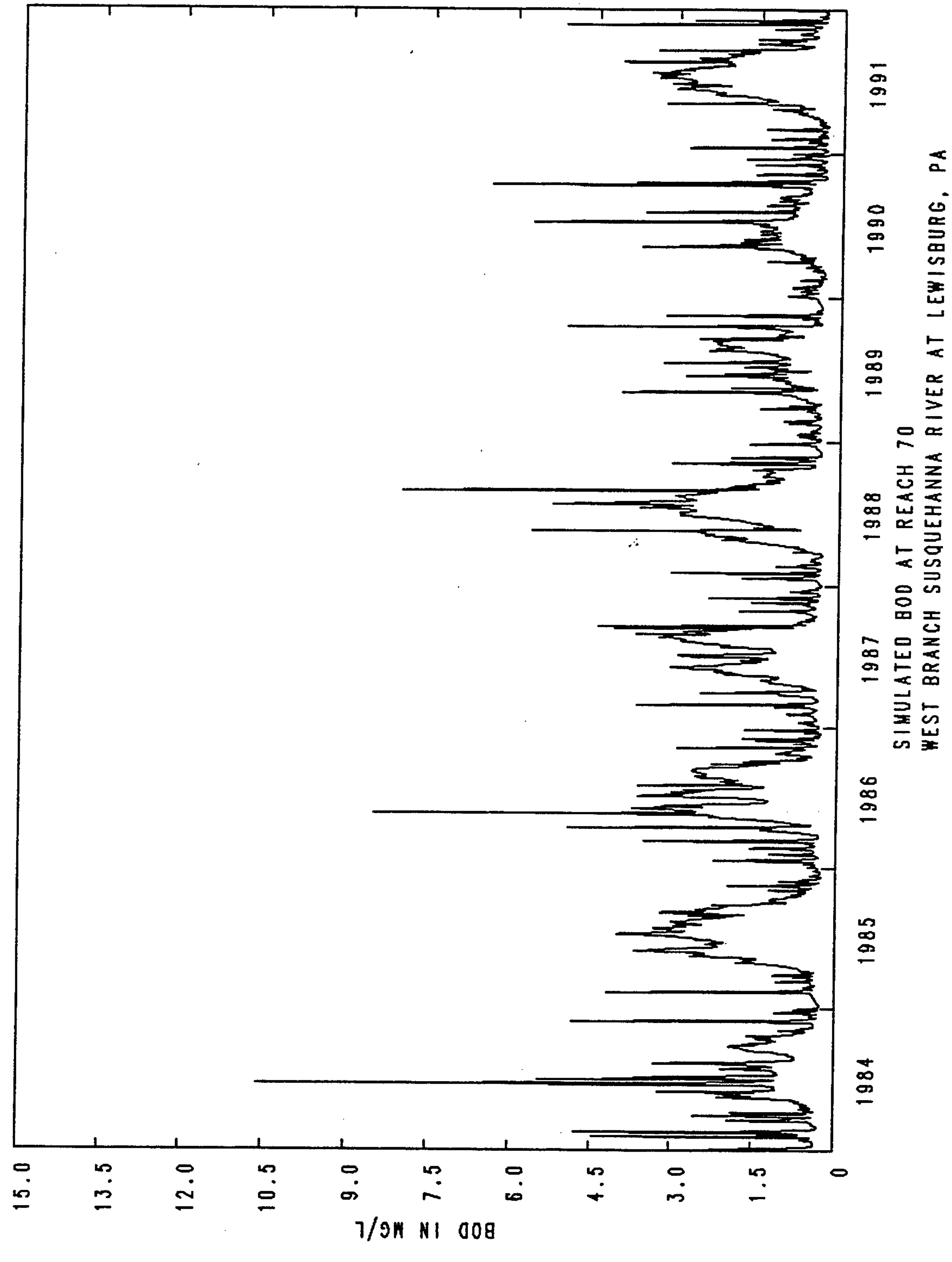

SIMULATED AND OBSERVED TOTAL P AT REACH 70
WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA
SIM TOTAL P
OBS TOTAL P
FLOW(CFS)
200000
100000
0
TOTAL P IN MG/L
0.80
0.72
0.64
0.56
0.48
0.40
0.32
0.24
0.16
0.08
0
1984
1985
1986
1987
1988
1989
1990
1991

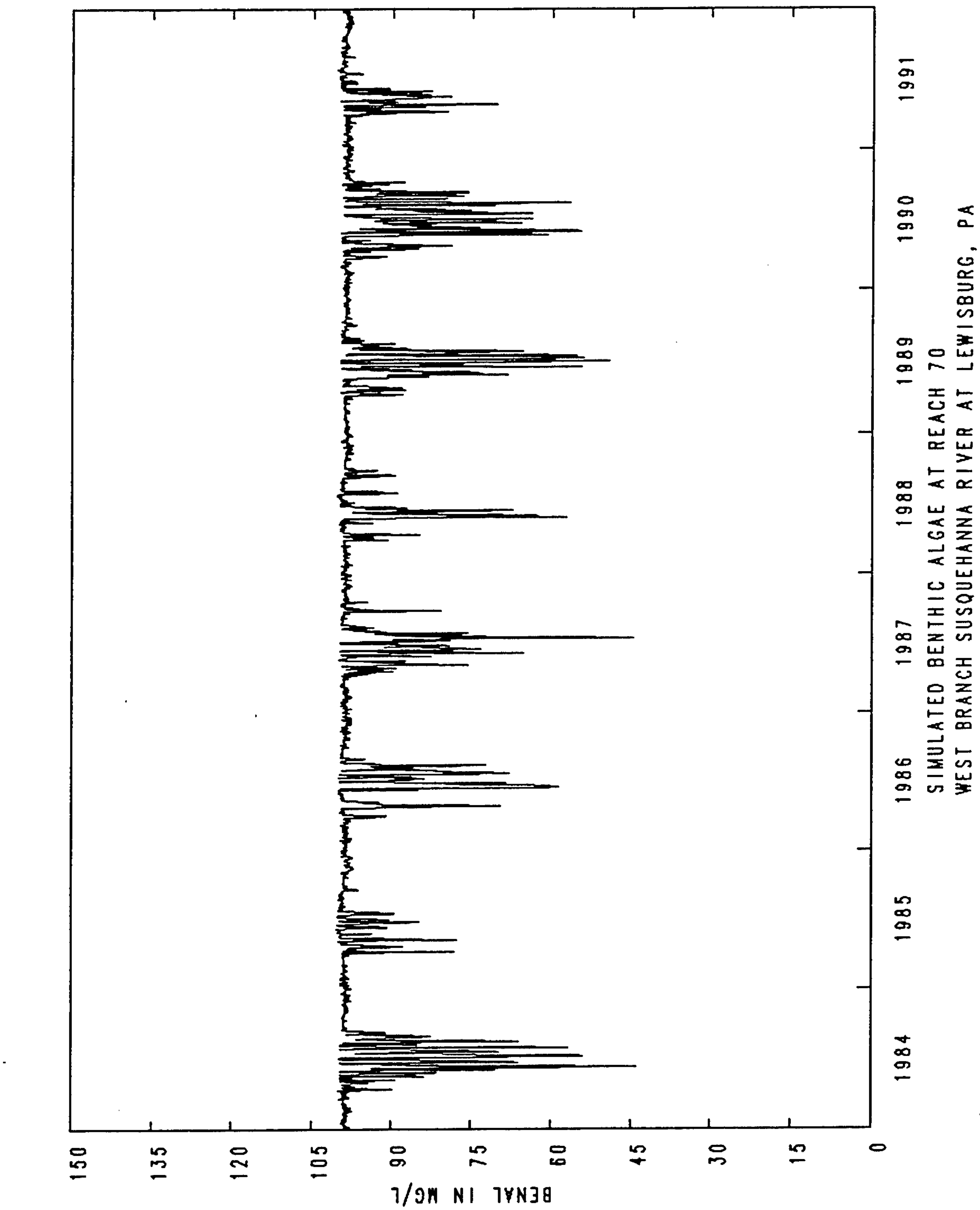


SIMULATED AND OBSERVED TOC AT REACH 70
WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA



SIMULATED CHLOROPHYLL A CONC AT REACH 70
WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA
SIM CHL A
FLOW(CFS)
CHL A IN UG/L
200000
100000
0
50
45
40
35
30
25
20
15
10
5
0
1984
1985
1986
1987
1988
1989
1990
1991


SIMULATED BOD AT REACH 70
WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA
BOD IN MG/L
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5
0
1984
1985
1986
1987
1988
1989
1990
1991


SIMULATED BENTHIC ALGAE AT REACH 70
WEST BRANCH SUSQUEHANNA RIVER AT LEWISBURG, PA
BENAL IN MG/L
150
135
120
105
90
75
60
45
30
15
0
1984
1985
1986
1987
1988
1989
1990
1991

AGCHEM RESULTS FOR WEST BRANCH SUSQUEHANNA (HI-TILL), SEGMENT 52

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	48.55	42.61	50.40	41.90	45.86
Runoff (in)					
Surface	11.41	8.513	14.62	8.522	10.77
Interflow	7.745	6.901	6.827	6.048	6.880
Baseflow	7.994	8.258	7.484	7.090	7.707
Total	27.14	23.67	28.93	21.66	25.35
Sediment Loss (t/a)	0.5620	0.3100	0.5170	0.2800	0.4172
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	1.362	0.6127	1.377	1.285	1.159
Interflow	14.81	6.571	5.982	10.99	9.588
Baseflow	6.415	4.427	5.556	3.812	5.053
Total	22.59	11.61	12.92	16.08	15.80
NH3 Loss					
Surface	2.415	1.264	3.191	7.690	3.640
Interflow	1.886	1.660	1.262	1.853	1.665
Baseflow	0.8506E-01	0.6147E-01	0.4248E-01	0.3398E-01	0.5575E-01
Sediment	0.6463E-02	0.3276E-02	0.6014E-02	0.4239E-02	0.4998E-02
Total	4.393	2.989	4.501	9.582	5.366
ORGN Sediment	1.822	1.005	1.691	0.8992	1.354
Total N Loss (lb/a)	28.81	15.61	19.11	26.56	22.52
PO4 Loss					
Surface	0.4987	0.4324	0.8808	0.6483	0.6151
Interflow	0.3967	0.2019	0.2091	0.1526	0.2401
Baseflow	0.2258E-02	0.1243E-03	0.4387E-04	0.8535E-05	0.6087E-03
Sediment	0.2285E-01	0.1306E-01	0.2272E-01	0.1235E-01	0.1775E-01
Total	0.9205	0.6475	1.113	0.8133	0.8736
ORGP Sediment	0.5055	0.2783	0.4686	0.2496	0.3755
Total P Loss (lb/a)	1.426	0.9258	1.581	1.063	1.249
Atm Depn. NO3 (lb/a)	8.929	8.620	8.908	8.515	8.743
Atm Depn. NH4 (lb/a)	2.511	2.212	2.467	2.313	2.376
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	71.03	72.97	72.97	72.97	72.49
Nitrate appln.(lb/a)	18.74	19.39	19.39	19.39	19.23
ORGN appln.(lb/a)	18.30	18.30	18.30	18.30	18.30
Total N appln.(lb/a)	108.1	110.7	110.7	110.7	110.0
PO4-p appln.(lb/a)	19.86	20.97	20.97	20.97	20.69
ORGP appln.(lb/a)	3.900	3.900	3.900	3.900	3.900
Total P appln.(lb/a)	23.76	24.87	24.87	24.87	24.59
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.7000E-02	0.3000E-02	0.6000E-02	0.5000E-02	0.5250E-02
Upper	54.97	67.04	61.55	59.44	60.75
Lower	36.17	45.92	46.72	37.53	41.59
Total	91.15	113.0	108.3	96.98	102.3
Phosphorus					
Surface	0.7000E-02	0.2000E-02	0.5000E-02	0.5000E-02	0.4750E-02
Upper	15.22	16.58	16.12	15.69	15.90
Lower	3.753	3.752	3.752	3.276	3.633
Total	18.98	20.34	19.87	18.97	19.54
Deficit (lb/a)					
Nitrogen					
Surface	1.194	1.198	1.195	1.195	1.196
Upper	16.84	4.793	10.29	12.38	11.08
Lower	10.99	1.236	0.4325	9.626	5.571
Total	29.02	7.227	11.92	23.20	17.84
Phosphorus					
Surface	1.244	1.248	1.245	1.246	1.246
Upper	4.802	3.430	3.909	4.340	4.120
Lower	0.0000	0.0000	0.0000	0.4762	0.1190
Total	6.046	4.678	5.154	6.062	5.485
Other Fluxes-lb/ac					
N Mineralization	27.43	37.07	33.66	30.34	32.13
P Mineralization	1.215	1.298	1.196	1.149	1.214
Denitrification	1.076	1.020	1.324	0.7722	1.048
N Immobilization	9.051	11.27	11.47	9.617	10.35
P Immobilization	5.673	4.567	4.716	5.068	5.006

AGCHEM RESULTS FOR WEST BRANCH SUSQUEHANNA (HI-TILL), SEGMENT 52

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	38.64	42.72	51.99	35.98	42.33
Runoff (in)					
Surface	6.852	9.980	11.71	6.068	8.654
Interflow	6.557	7.676	9.391	6.871	7.624
Baseflow	7.389	8.146	9.284	6.222	7.760
Total	20.80	25.80	30.39	19.16	24.04
Sediment Loss (t/a)	0.1660	0.2160	0.3940	0.1060	0.2205
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.7288	2.699	1.032	0.8512	1.328
Interflow	12.82	13.62	14.63	4.580	11.41
Baseflow	3.661	1.963	3.594	3.012	3.057
Total	17.21	18.28	19.26	8.443	15.80
NH3 Loss					
Surface	2.778	6.436	3.770	0.9556	3.485
Interflow	1.974	2.734	2.625	1.900	2.308
Baseflow	0.3364E-01	0.3374E-01	0.3588E-01	0.2426E-01	0.3188E-01
Sediment	0.1789E-02	0.2792E-02	0.4402E-02	0.1214E-02	0.2549E-02
Total	4.787	9.207	6.435	2.881	5.828
ORGN Sediment	0.5055	0.6369	1.258	0.3032	0.6759
Total N Loss (lb/a)	22.51	28.12	26.95	11.63	22.30
PO4 Loss					
Surface	0.4979	0.6728	0.8248	0.2594	0.5637
Interflow	0.2731	0.2588	0.3723	0.1774	0.2704
Baseflow	0.1715E-05	0.1065E-05	0.1982E-05	0.1361E-05	0.1531E-05
Sediment	0.7119E-02	0.8955E-02	0.1698E-01	0.3991E-02	0.9261E-02
Total	0.7781	0.9406	1.214	0.4408	0.8434
ORGP Sediment	0.1402	0.1766	0.3496	0.8413E-01	0.1876
Total P Loss (lb/a)	0.9182	1.117	1.564	0.5249	1.031
Atm Depn. NO3 (lb/a)	8.061	8.736	8.982	7.794	8.393
Atm Depn. NH4 (lb/a)	1.965	2.426	2.487	1.790	2.167
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	72.21	66.92	72.97	71.89	71.00
Nitrate appln.(lb/a)	19.14	17.37	19.39	19.03	18.73
ORGN appln.(lb/a)	18.30	18.30	18.30	18.30	18.30
Total N appln.(lb/a)	109.7	102.6	110.7	109.2	108.0
PO4-p appln.(lb/a)	20.54	17.49	20.97	20.97	19.99
ORGP appln.(lb/a)	3.900	3.900	3.900	3.900	3.900
Total P appln.(lb/a)	24.44	21.39	24.87	24.87	23.89
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.8000E-02	0.1300E-01	0.1800E-01	0.7000E-02	0.1150E-01
Upper	57.95	55.60	60.92	65.81	60.07
Lower	43.08	25.96	36.25	43.98	37.32
Total	101.0	81.57	97.19	109.8	97.40
Phosphorus					
Surface	0.8000E-02	0.1100E-01	0.1500E-01	0.8000E-02	0.1050E-01
Upper	15.87	13.71	15.49	15.73	15.20
Lower	0.5360	0.3570	0.4290	0.2960	0.4045
Total	16.41	14.08	15.93	16.03	15.61
Deficit (lb/a)					
Nitrogen					
Surface	1.193	1.188	1.183	1.193	1.189
Upper	13.86	16.19	10.90	5.987	11.73
Lower	4.091	21.19	10.91	3.184	9.844
Total	19.15	38.57	22.99	10.36	22.77
Phosphorus					
Surface	1.243	1.240	1.236	1.243	1.240
Upper	4.152	6.305	4.521	4.284	4.816
Lower	3.217	3.395	3.323	3.456	3.348
Total	8.611	10.94	9.080	8.983	9.403
Other Fluxes-lb/ac					
N Mineralization	32.19	23.11	28.73	34.24	29.57
P Mineralization	0.9393	0.7716	0.8533	0.8425	0.8517
Denitrification	0.7602	0.2988	0.5341	0.8270	0.6050
N Immobilization	10.37	8.788	10.22	10.71	10.02
P Immobilization	4.677	3.221	5.449	3.384	4.183

AGCHEM RESULTS FOR WEST BRANCH SUSQUEHANNA (LOW-TILL), SEGMENT 53

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	48.55	42.61	50.40	41.90	45.86
Runoff (in)					
Surface	9.731	7.199	13.47	7.172	9.394
Interflow	7.852	7.152	6.880	6.201	7.021
Baseflow	8.471	8.693	7.822	7.588	8.144
Total	26.05	23.04	28.18	20.96	24.56
Sediment Loss (t/a)	0.3230	0.1740	0.3050	0.1560	0.2395
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.8141	0.4797	1.595	1.191	1.020
Interflow	18.15	6.036	7.984	14.42	11.65
Baseflow	6.224	5.576	8.628	5.258	6.422
Total	25.19	12.09	18.21	20.87	19.09
NH3 Loss					
Surface	2.669	1.018	3.063	10.65	4.350
Interflow	1.703	1.605	1.232	1.879	1.605
Baseflow	0.8760E-01	0.6111E-01	0.4186E-01	0.3343E-01	0.5600E-01
Sediment	0.3593E-02	0.1785E-02	0.3601E-02	0.2049E-02	0.2757E-02
Total	4.463	2.686	4.340	12.56	6.012
ORGN Sediment	1.289	0.6908	1.215	0.6050	0.9499
Total N Loss (lb/a)	30.94	15.47	23.76	34.04	26.05
PO4 Loss					
Surface	0.6020	0.4493	1.067	0.7196	0.7095
Interflow	0.3963	0.1227	0.1398	0.1110	0.1925
Baseflow	0.2268E-02	0.1134E-03	0.2596E-04	0.2207E-05	0.6024E-03
Sediment	0.1303E-01	0.7198E-02	0.1324E-01	0.6673E-02	0.1004E-01
Total	1.014	0.5793	1.220	0.8372	0.9126
ORGP Sediment	0.3438	0.1839	0.3239	0.1615	0.2533
Total P Loss (lb/a)	1.357	0.7633	1.544	0.9987	1.166
Atm Depn. NO3 (lb/a)	8.929	8.620	8.908	8.515	8.743
Atm Depn. NH4 (lb/a)	2.511	2.212	2.467	2.313	2.376
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	82.04	84.57	84.57	84.57	83.94
Nitrate appln.(lb/a)	21.89	22.73	22.73	22.73	22.52
ORGN appln.(lb/a)	20.28	20.28	20.28	20.28	20.28
Total N appln.(lb/a)	124.2	127.6	127.6	127.6	126.7
PO4-p appln.(lb/a)	22.71	24.16	24.16	24.16	23.80
ORGP appln.(lb/a)	4.320	4.320	4.320	4.320	4.320
Total P appln.(lb/a)	27.03	28.48	28.48	28.48	28.12
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.2700E-01	0.1600E-01	0.1800E-01	0.2500E-01	0.2150E-01
Upper	63.51	76.53	68.52	64.34	68.22
Lower	39.00	51.09	51.10	41.64	45.71
Total	102.5	127.6	119.6	106.0	114.0
Phosphorus					
Surface	0.2600E-01	0.1600E-01	0.1900E-01	0.2500E-01	0.2150E-01
Upper	16.07	17.73	17.42	16.19	16.85
Lower	4.203	4.202	4.202	1.660	3.567
Total	20.30	21.95	21.64	17.88	20.44
Deficit (lb/a)					
Nitrogen					
Surface	1.274	1.285	1.283	1.276	1.280
Upper	14.31	1.252	9.307	13.44	9.577
Lower	12.11	0.0000	0.0000	9.443	5.388
Total	27.70	2.536	10.59	24.16	16.25
Phosphorus					
Surface	1.375	1.385	1.381	1.376	1.379
Upper	6.358	4.688	5.003	6.219	5.567
Lower	0.0000	0.0000	0.0000	2.542	0.6355
Total	7.733	6.073	6.384	10.14	7.582
Other Fluxes-lb/ac					
N Mineralization	29.64	40.99	37.84	32.69	35.29
P Mineralization	1.344	1.376	1.330	1.063	1.278
Denitrification	1.029	1.340	1.888	1.027	1.321
N Immobilization	10.87	13.27	13.69	11.02	12.21
P Immobilization	8.571	6.856	6.724	7.621	7.443

AGCHEM RESULTS FOR WEST BRANCH SUSQUEHANNA (LOW-TILL), SEGMENT 53

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	38.64	42.72	51.99	35.98	42.33
Runoff (in)					
Surface	5.555	8.544	9.494	4.831	7.106
Interflow	6.706	8.005	10.09	7.338	8.035
Baseflow	7.676	8.616	10.10	6.528	8.231
Total	19.94	25.16	29.69	18.70	23.37
Sediment Loss (t/a)	0.9098E-01	0.1250	0.2130	0.5584E-01	0.1212
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.4922	2.295	0.8653	0.4140	1.017
Interflow	14.77	17.48	19.35	4.739	14.08
Baseflow	3.452	1.766	3.905	3.610	3.183
Total	18.71	21.54	24.12	8.763	18.28
NH3 Loss					
Surface	1.780	7.869	4.196	1.249	3.773
Interflow	1.986	3.006	3.042	2.134	2.542
Baseflow	0.3125E-01	0.3137E-01	0.3504E-01	0.2271E-01	0.3009E-01
Sediment	0.9717E-03	0.1567E-02	0.2304E-02	0.4519E-03	0.1324E-02
Total	3.798	10.91	7.276	3.406	6.348
ORGN Sediment	0.3416	0.4491	0.8240	0.1644	0.4448
Total N Loss (lb/a)	22.85	32.90	32.22	12.33	25.08
PO4 Loss					
Surface	0.6491	0.8713	0.9914	0.3149	0.7067
Interflow	0.2583	0.3054	0.3271	0.1147	0.2514
Baseflow	0.1182E-05	0.1117E-05	0.1520E-05	0.8517E-06	0.1168E-05
Sediment	0.3965E-02	0.5114E-02	0.9011E-02	0.1741E-02	0.4958E-02
Total	0.9113	1.182	1.328	0.4313	0.9631
ORGP Sediment	0.9114E-01	0.1197	0.2207	0.4381E-01	0.1188
Total P Loss (lb/a)	1.002	1.301	1.548	0.4751	1.082
Atm Depn. NO3 (lb/a)	8.061	8.736	8.982	7.794	8.393
Atm Depn. NH4 (lb/a)	1.965	2.426	2.487	1.790	2.167
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	83.58	76.66	84.57	84.00	82.20
Nitrate appln.(lb/a)	22.40	20.09	22.73	22.54	21.94
ORGN appln.(lb/a)	20.28	20.28	20.28	20.28	20.28
Total N appln.(lb/a)	126.3	117.0	127.6	126.8	124.4
PO4-p appln.(lb/a)	23.59	19.62	24.16	24.16	22.88
ORGP appln.(lb/a)	4.320	4.320	4.320	4.320	4.320
Total P appln.(lb/a)	27.91	23.94	28.48	28.48	27.20
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.2400E-01	0.4200E-01	0.3300E-01	0.2400E-01	0.3075E-01
Upper	71.20	62.26	68.68	73.07	68.80
Lower	43.61	26.47	38.40	51.09	39.89
Total	114.8	88.78	107.1	124.2	108.7
Phosphorus					
Surface	0.2200E-01	0.3800E-01	0.3100E-01	0.2600E-01	0.2925E-01
Upper	16.90	14.05	15.48	18.42	16.21
Lower	0.3510	0.3230	0.3540	0.2260	0.3135
Total	17.27	14.41	15.87	18.67	16.56
Deficit (lb/a)					
Nitrogen					
Surface	1.277	1.259	1.267	1.277	1.270
Upper	6.596	15.51	9.142	4.730	8.995
Lower	7.474	24.61	12.70	0.0000	11.20
Total	15.35	41.38	23.10	6.006	21.46
Phosphorus					
Surface	1.379	1.363	1.370	1.375	1.372
Upper	5.517	8.359	6.931	3.995	6.201
Lower	3.852	3.879	3.849	3.976	3.889
Total	10.75	13.60	12.15	9.346	11.46
Other Fluxes-lb/ac					
N Mineralization	33.37	24.09	30.88	39.50	31.96
P Mineralization	1.021	0.8406	0.9315	0.9708	0.9410
Denitrification	0.6947	0.2655	0.5547	1.040	0.6387
N Immobilization	12.24	9.852	12.17	13.18	11.86
P Immobilization	6.915	4.863	8.339	4.807	6.231

AGCHEM RESULTS FOR WEST BRANCH SUSQUEHANNA (HAY), SEGMENT 56

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	48.55	42.61	50.40	41.90	45.86
Runoff (in)					
Surface	13.61	9.611	16.62	9.778	12.40
Interflow	7.807	7.255	7.199	6.252	7.128
Baseflow	7.588	7.528	6.847	6.738	7.175
Total	29.01	24.39	30.66	22.77	26.71
Sediment Loss (t/a)	0.2120	0.1080	0.1850	0.1100	0.1538
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	1.175	0.7629	0.8364	0.7965	0.8927
Interflow	5.120	4.260	4.467	5.483	4.832
Baseflow	10.18	11.82	11.49	10.64	11.03
Total	16.48	16.84	16.79	16.92	16.76
NH3 Loss					
Surface	2.037	1.356	0.8527	1.534	1.445
Interflow	0.4855	0.6731	0.3998	0.6176	0.5440
Baseflow	0.8280E-01	0.6011E-01	0.4489E-01	0.3844E-01	0.5656E-01
Sediment	0.2136E-02	0.1179E-02	0.1816E-02	0.1123E-02	0.1563E-02
Total	2.607	2.090	1.299	2.192	2.047
ORGN Sediment	0.5311	0.2550	0.4684	0.2629	0.3794
Total N Loss (lb/a)	19.62	19.19	18.56	19.38	19.19
PO4 Loss					
Surface	1.254	0.8639	0.7595	1.155	1.008
Interflow	0.4134	0.2488	0.1827	0.1632	0.2520
Baseflow	0.2265E-02	0.1620E-03	0.1051E-03	0.7318E-04	0.6513E-03
Sediment	0.8326E-02	0.4546E-02	0.7399E-02	0.4872E-02	0.6286E-02
Total	1.678	1.117	0.9496	1.323	1.267
ORGP Sediment	0.1424	0.6851E-01	0.1261	0.7086E-01	0.1020
Total P Loss (lb/a)	1.820	1.186	1.076	1.394	1.369
Atm Depn. NO3 (lb/a)	8.929	8.620	8.908	8.515	8.743
Atm Depn. NH4 (lb/a)	2.511	2.212	2.467	2.313	2.376
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	22.51	22.51	22.51	22.17	22.43
Nitrate appln.(lb/a)	7.510	7.510	7.510	7.397	7.482
ORGN appln.(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Total N appln.(lb/a)	30.02	30.02	30.02	29.57	29.91
PO4-p appln.(lb/a)	13.00	13.00	13.00	12.81	12.95
ORGP appln.(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Total P appln.(lb/a)	13.00	13.00	13.00	12.81	12.95
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.7000E-02	0.4000E-02	0.6000E-02	0.5000E-02	0.5500E-02
Upper	22.00	22.79	23.24	20.53	22.14
Lower	17.68	17.68	17.68	17.68	17.68
Total	39.69	40.48	40.92	38.22	39.83
Phosphorus					
Surface	0.1100E-01	0.7000E-02	0.1000E-01	0.8000E-02	0.9000E-02
Upper	10.75	10.39	10.45	10.27	10.47
Lower	2.252	2.251	2.251	2.251	2.251
Total	13.02	12.64	12.71	12.53	12.73
Deficit (lb/a)					
Nitrogen					
Surface	0.4429	0.4458	0.4438	0.4448	0.4443
Upper	4.933	4.129	3.690	6.385	4.784
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	5.376	4.575	4.133	6.830	5.228
Phosphorus					
Surface	0.7394	0.7437	0.7404	0.7419	0.7413
Upper	1.258	1.620	1.560	1.740	1.544
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	1.997	2.364	2.300	2.482	2.286
Other Fluxes-lb/ac					
N Mineralization	27.16	28.08	27.51	26.93	27.42
P Mineralization	1.174	1.168	1.123	1.132	1.149
Denitrification	2.169	2.451	2.582	2.393	2.399
N Immobilization	6.339	7.430	7.555	7.199	7.131
P Immobilization	3.192	2.653	2.639	2.420	2.726

AGCHEM RESULTS FOR WEST BRANCH SUSQUEHANNA (HAY), SEGMENT 56

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	38.64	42.72	51.99	35.98	42.33
Runoff (in)					
Surface	8.051	11.19	13.58	6.934	9.938
Interflow	6.859	7.802	9.670	6.998	7.832
Baseflow	6.642	7.606	8.570	5.732	7.137
Total	21.55	26.60	31.82	19.66	24.91
Sediment Loss (t/a)	0.6538E-01	0.8007E-01	0.1520	0.3998E-01	0.8436E-01
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.6091	1.238	0.6786	0.6084	0.7835
Interflow	4.340	5.047	5.977	3.736	4.775
Baseflow	12.15	11.72	12.08	9.169	11.28
Total	17.10	18.01	18.73	13.51	16.84
NH3 Loss					
Surface	0.6860	3.035	1.020	0.3565	1.274
Interflow	0.5147	0.8482	0.5634	0.2905	0.5542
Baseflow	0.3520E-01	0.3834E-01	0.4089E-01	0.2633E-01	0.3519E-01
Sediment	0.5479E-03	0.6973E-03	0.1492E-02	0.2471E-03	0.7461E-03
Total	1.236	3.922	1.626	0.6736	1.864
ORGN Sediment	0.1395	0.1635	0.3696	0.6340E-01	0.1840
Total N Loss (lb/a)	18.48	22.09	20.73	14.25	18.89
PO4 Loss					
Surface	0.6925	1.685	1.078	0.3541	0.9524
Interflow	0.1453	0.2040	0.2016	0.1087	0.1649
Baseflow	0.5251E-04	0.3459E-04	0.1666E-04	0.3922E-05	0.2692E-04
Sediment	0.2295E-02	0.2789E-02	0.6611E-02	0.1031E-02	0.3182E-02
Total	0.8402	1.891	1.286	0.4638	1.120
ORGP Sediment	0.3772E-01	0.4380E-01	0.9945E-01	0.1699E-01	0.4949E-01
Total P Loss (lb/a)	0.8780	1.935	1.386	0.4808	1.170
Atm Depn. NO3 (lb/a)	8.061	8.736	8.982	7.794	8.393
Atm Depn. NH4 (lb/a)	1.965	2.426	2.487	1.790	2.167
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	22.51	22.51	22.51	22.51	22.51
Nitrate appln.(lb/a)	7.510	7.510	7.510	7.510	7.510
ORGN appln.(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Total N appln.(lb/a)	30.02	30.02	30.02	30.02	30.02
PO4-p appln.(lb/a)	13.00	13.00	13.00	13.00	13.00
ORGP appln.(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Total P appln.(lb/a)	13.00	13.00	13.00	13.00	13.00
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.7000E-02	0.1200E-01	0.1000E-01	0.6000E-02	0.8750E-02
Upper	21.48	20.04	21.98	21.87	21.34
Lower	17.68	17.68	17.68	17.68	17.68
Total	39.17	37.74	39.67	39.56	39.03
Phosphorus					
Surface	0.1000E-01	0.1600E-01	0.1400E-01	0.1000E-01	0.1250E-01
Upper	10.04	8.941	11.29	8.149	9.604
Lower	2.252	2.251	2.251	1.362	2.029
Total	12.30	11.21	13.56	9.521	11.65
Deficit (lb/a)					
Nitrogen					
Surface	0.4434	0.4385	0.4400	0.4442	0.4415
Upper	5.461	6.879	4.947	5.055	5.586
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	5.905	7.317	5.387	5.499	6.027
Phosphorus					
Surface	0.7404	0.7341	0.7365	0.7408	0.7379
Upper	1.971	3.066	0.7200	3.857	2.404
Lower	0.0000	0.0000	0.0000	0.8889	0.2222
Total	2.712	3.800	1.457	5.486	3.364
Other Fluxes-lb/ac					
N Mineralization	29.28	26.57	26.70	29.02	27.89
P Mineralization	1.191	1.060	1.186	0.8860	1.081
Denitrification	2.719	2.330	2.294	2.622	2.491
N Immobilization	7.799	6.612	7.433	7.998	7.460
P Immobilization	2.388	2.070	2.145	2.351	2.238

AGCHEM RESULTS FOR WEST BRANCH SUSQUEHANNA (HI-TILL), SEGMENT 62

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	50.29	36.74	42.44	37.48	41.74
Runoff (in)					
Surface	11.27	4.767	7.180	5.640	7.213
Interflow	8.591	5.224	6.711	5.214	6.435
Baseflow	8.016	6.228	6.842	6.250	6.834
Total	27.87	16.22	20.73	17.10	20.48
Sediment Loss (t/a)	1.260	0.2380	0.5150	0.3020	0.5788
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	1.589	0.3799	0.6426	0.5646	0.7940
Interflow	18.58	5.851	8.465	11.29	11.05
Baseflow	6.207	4.748	7.512	7.210	6.419
Total	26.38	10.98	16.62	19.06	18.26
NH3 Loss					
Surface	3.673	1.619	1.430	1.881	2.151
Interflow	2.268	1.182	2.245	1.563	1.814
Baseflow	0.7586E-01	0.4055E-01	0.3604E-01	0.2779E-01	0.4506E-01
Sediment	0.1641E-01	0.2560E-02	0.5572E-02	0.3893E-02	0.7109E-02
Total	6.034	2.844	3.716	3.476	4.017
ORGN Sediment	4.040	0.7393	1.632	0.9415	1.838
Total N Loss (lb/a)	36.45	14.56	21.97	23.48	24.11
PO4 Loss					
Surface	0.4700	0.3096	0.5243	0.5051	0.4523
Interflow	0.4322	0.1381	0.2741	0.1223	0.2417
Baseflow	0.1954E-02	0.5995E-04	0.2989E-04	0.3607E-05	0.5119E-03
Sediment	0.5358E-01	0.1021E-01	0.2332E-01	0.1357E-01	0.2517E-01
Total	0.9578	0.4580	0.8218	0.6409	0.7196
ORGP Sediment	1.121	0.2048	0.4525	0.2614	0.5099
Total P Loss (lb/a)	2.079	0.6627	1.274	0.9022	1.229
Atm Depn. NO3 (lb/a)	9.127	8.393	8.786	8.481	8.697
Atm Depn. NH4 (lb/a)	2.574	2.101	2.361	2.238	2.318
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	76.81	80.76	80.76	80.76	79.77
Nitrate appln.(lb/a)	20.25	21.57	21.57	21.57	21.24
ORGN appln.(lb/a)	19.74	19.74	19.74	19.74	19.74
Total N appln.(lb/a)	116.8	122.1	122.1	122.1	120.8
PO4-p appln.(lb/a)	20.78	23.03	23.03	23.03	22.47
ORGP appln.(lb/a)	4.140	4.140	4.140	4.140	4.140
Total P appln.(lb/a)	24.92	27.17	27.17	27.17	26.61
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.2400E-01	0.1300E-01	0.1000E-01	0.1100E-01	0.1450E-01
Upper	52.85	72.20	65.52	65.50	64.02
Lower	36.95	49.12	49.12	49.13	46.08
Total	89.83	121.3	114.7	114.6	110.1
Phosphorus					
Surface	0.2100E-01	0.9000E-02	0.8000E-02	0.9000E-02	0.1175E-01
Upper	15.06	18.27	16.58	16.55	16.61
Lower	3.753	3.752	3.752	2.588	3.461
Total	18.83	22.03	20.34	19.15	20.09
Deficit (lb/a)					
Nitrogen					
Surface	1.227	1.238	1.241	1.240	1.237
Upper	21.95	2.628	9.268	9.308	10.79
Lower	12.18	0.0000	0.0000	0.0000	3.045
Total	35.35	3.865	10.51	10.55	15.07
Phosphorus					
Surface	1.230	1.241	1.243	1.242	1.239
Upper	4.971	1.741	3.436	3.467	3.404
Lower	0.0000	0.0000	0.0000	1.164	0.2910
Total	6.201	2.983	4.679	5.873	4.934
Other Fluxes-lb/ac					
N Mineralization	25.19	37.77	34.40	38.03	33.85
P Mineralization	1.268	1.202	1.175	1.088	1.183
Denitrification	1.003	1.568	1.907	2.068	1.637
N Immobilization	9.496	12.25	11.78	11.88	11.35
P Immobilization	6.646	5.389	6.119	6.538	6.173

AGCHEM RESULTS FOR WEST BRANCH SUSQUEHANNA (HI-TILL), SEGMENT 62

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	32.93	37.44	48.26	32.01	37.66
Runoff (in)					
Surface	4.114	6.580	7.889	3.663	5.562
Interflow	4.459	6.717	9.084	5.562	6.456
Baseflow	5.376	6.806	8.549	5.589	6.580
Total	13.95	20.10	25.52	14.81	18.60
Sediment Loss (t/a)	0.1970	0.3450	0.3820	0.1280	0.2630
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.3155	1.281	0.7214	0.3869	0.6762
Interflow	15.90	19.74	17.18	4.246	14.27
Baseflow	4.052	2.636	4.153	5.486	4.082
Total	20.27	23.66	22.05	10.12	19.03
NH3 Loss					
Surface	1.514	2.602	1.872	0.8412	1.707
Interflow	2.062	3.272	2.829	1.714	2.469
Baseflow	0.2164E-01	0.2520E-01	0.3028E-01	0.1937E-01	0.2412E-01
Sediment	0.2345E-02	0.4250E-02	0.4486E-02	0.1313E-02	0.3099E-02
Total	3.601	5.903	4.735	2.575	4.204
ORGN Sediment	0.6128	1.079	1.174	0.3809	0.8117
Total N Loss (lb/a)	24.48	30.64	27.96	13.07	24.04
PO4 Loss					
Surface	0.5196	0.5131	0.5884	0.2286	0.4624
Interflow	0.3404	0.4769	0.3576	0.1273	0.3255
Baseflow	0.1153E-05	0.1735E-05	0.1376E-05	0.1020E-05	0.1321E-05
Sediment	0.9213E-02	0.1539E-01	0.1641E-01	0.5309E-02	0.1158E-01
Total	0.8693	1.005	0.9625	0.3612	0.7995
ORGP Sediment	0.1695	0.2995	0.3262	0.1057	0.2252
Total P Loss (lb/a)	1.039	1.305	1.289	0.4669	1.025
Atm Depn. NO3 (lb/a)	8.048	8.526	8.925	7.696	8.299
Atm Depn. NH4 (lb/a)	1.955	2.289	2.420	1.698	2.091
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	79.52	80.76	77.82	79.23	79.33
Nitrate appln.(lb/a)	21.16	21.57	20.59	21.06	21.09
ORGN appln.(lb/a)	19.74	19.74	19.74	19.74	19.74
Total N appln.(lb/a)	120.4	122.1	118.2	120.0	120.2
PO4-p appln.(lb/a)	22.33	23.03	22.45	22.55	22.59
ORGP appln.(lb/a)	4.140	4.140	4.140	4.140	4.140
Total P appln.(lb/a)	26.47	27.17	26.59	26.69	26.73
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.7000E-02	0.2000E-01	0.1700E-01	0.7000E-02	0.1275E-01
Upper	58.45	67.91	61.33	61.60	62.32
Lower	49.13	34.12	38.31	49.12	42.67
Total	107.6	102.0	99.66	110.7	105.0
Phosphorus					
Surface	0.5000E-02	0.1700E-01	0.1500E-01	0.6000E-02	0.1075E-01
Upper	16.49	15.54	16.08	16.04	16.04
Lower	0.4140	0.4700	0.4380	0.2700	0.3980
Total	16.91	16.02	16.53	16.31	16.44
Deficit (lb/a)					
Nitrogen					
Surface	1.244	1.230	1.234	1.244	1.238
Upper	16.38	6.889	13.48	13.18	12.48
Lower	0.0000	15.01	10.84	0.0000	6.463
Total	17.62	23.13	25.55	14.42	20.18
Phosphorus					
Surface	1.246	1.234	1.236	1.245	1.240
Upper	3.524	4.478	3.940	3.974	3.979
Lower	3.339	3.281	3.313	3.482	3.354
Total	8.109	8.993	8.490	8.700	8.573
Other Fluxes-lb/ac					
N Mineralization	33.83	29.86	27.26	35.26	31.55
P Mineralization	0.8657	0.8231	0.8279	0.8434	0.8400
Denitrification	0.9908	0.4804	0.6721	1.497	0.9101
N Immobilization	12.61	11.19	10.60	11.98	11.59
P Immobilization	5.554	6.904	6.564	4.214	5.809

AGCHEM RESULTS FOR WEST BRANCH SUSQUEHANNA (LOW-TILL), SEGMENT 63

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	50.29	36.74	42.44	37.48	41.74
Runoff (in)					
Surface	9.650	3.678	5.633	4.432	5.848
Interflow	8.685	5.418	6.906	5.305	6.579
Baseflow	8.561	6.631	7.349	6.733	7.319
Total	26.90	15.73	19.89	16.47	19.75
Sediment Loss (t/a)	0.7450	0.1350	0.3280	0.1850	0.3482
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	1.328	0.3553	0.3401	0.4065	0.6075
Interflow	21.40	5.859	8.738	13.98	12.49
Baseflow	5.839	4.700	8.616	5.622	6.194
Total	28.56	10.91	17.69	20.01	19.29
NH3 Loss					
Surface	4.093	1.835	1.070	2.051	2.262
Interflow	1.996	1.124	2.111	1.521	1.688
Baseflow	0.7866E-01	0.4033E-01	0.3577E-01	0.2705E-01	0.4545E-01
Sediment	0.9337E-02	0.1446E-02	0.3404E-02	0.2234E-02	0.4105E-02
Total	6.177	3.000	3.220	3.601	4.000
ORGN Sediment	2.959	0.5149	1.284	0.7087	1.367
Total N Loss (lb/a)	37.70	14.43	22.20	24.32	24.66
PO4 Loss					
Surface	0.6519	0.3825	0.5169	0.6105	0.5404
Interflow	0.4011	0.9841E-01	0.2032	0.1071	0.2025
Baseflow	0.1961E-02	0.5450E-04	0.1846E-04	0.9925E-06	0.5087E-03
Sediment	0.3185E-01	0.5760E-02	0.1462E-01	0.8246E-02	0.1512E-01
Total	1.087	0.4868	0.7347	0.7258	0.7586
ORGP Sediment	0.7899	0.1372	0.3422	0.1893	0.3647
Total P Loss (lb/a)	1.877	0.6239	1.077	0.9151	1.123
Atm Depn. NO3 (lb/a)	9.127	8.393	8.786	8.481	8.697
Atm Depn. NH4 (lb/a)	2.574	2.101	2.361	2.238	2.318
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	83.89	88.53	88.53	88.53	87.37
Nitrate appln.(lb/a)	22.26	23.81	23.81	23.81	23.42
ORGN appln.(lb/a)	21.12	21.12	21.12	21.12	21.12
Total N appln.(lb/a)	127.3	133.5	133.5	133.5	131.9
PO4-p appln.(lb/a)	22.60	25.24	25.24	25.24	24.58
ORGP appln.(lb/a)	4.500	4.500	4.500	4.500	4.500
Total P appln.(lb/a)	27.10	29.74	29.74	29.74	29.08
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.5100E-01	0.2000E-01	0.2300E-01	0.2300E-01	0.2925E-01
Upper	58.10	78.97	72.11	74.17	70.83
Lower	37.50	53.06	53.06	51.41	48.76
Total	95.65	132.0	125.2	125.6	119.6
Phosphorus					
Surface	0.4700E-01	0.1500E-01	0.1900E-01	0.1800E-01	0.2475E-01
Upper	15.55	18.63	16.69	16.60	16.87
Lower	4.203	4.202	4.202	0.9470	3.388
Total	19.80	22.85	20.91	17.57	20.28
Deficit (lb/a)					
Nitrogen					
Surface	1.300	1.330	1.328	1.328	1.321
Upper	22.69	1.858	8.658	6.624	9.958
Lower	15.55	0.0000	0.0000	1.648	4.299
Total	39.54	3.189	9.986	9.600	15.58
Phosphorus					
Surface	1.354	1.385	1.381	1.383	1.376
Upper	6.879	3.785	5.723	5.810	5.549
Lower	0.0000	0.0000	0.0000	3.255	0.8138
Total	8.233	5.170	7.104	10.45	7.739
Other Fluxes-lb/ac					
N Mineralization	25.48	40.29	37.76	38.99	35.63
P Mineralization	1.374	1.232	1.252	0.9771	1.209
Denitrification	0.9183	1.457	2.107	1.614	1.524
N Immobilization	10.64	13.65	13.67	13.18	12.78
P Immobilization	8.626	7.153	8.281	8.490	8.138

AGCHEM RESULTS FOR WEST BRANCH SUSQUEHANNA (LOW-TILL), SEGMENT 63

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	32.93	37.44	48.26	32.01	37.66
Runoff (in)					
Surface	3.151	5.158	5.869	2.682	4.215
Interflow	4.526	6.963	9.702	5.921	6.778
Baseflow	5.625	7.317	9.334	5.835	7.028
Total	13.30	19.44	24.91	14.44	18.02
Sediment Loss (t/a)	0.9677E-01	0.1990	0.2180	0.6996E-01	0.1459
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.2459	1.080	0.5764	0.2287	0.5328
Interflow	17.19	22.20	20.76	5.268	16.35
Baseflow	2.588	2.053	4.019	5.154	3.454
Total	20.02	25.33	25.36	10.65	20.34
NH3 Loss					
Surface	0.9942	3.215	2.322	0.7670	1.825
Interflow	2.181	3.541	3.088	1.867	2.669
Baseflow	0.2014E-01	0.2383E-01	0.2873E-01	0.1745E-01	0.2254E-01
Sediment	0.1037E-02	0.2398E-02	0.2643E-02	0.6651E-03	0.1686E-02
Total	3.196	6.783	5.441	2.652	4.518
ORGN Sediment	0.3540	0.7653	0.8091	0.2420	0.5426
Total N Loss (lb/a)	23.57	32.88	31.61	13.54	25.40
PO4 Loss					
Surface	0.6193	0.7328	0.7711	0.2414	0.5911
Interflow	0.3648	0.5464	0.3420	0.9728E-01	0.3376
Baseflow	0.1162E-05	0.1750E-05	0.1215E-05	0.6039E-06	0.1183E-05
Sediment	0.4419E-02	0.8803E-02	0.9087E-02	0.2751E-02	0.6265E-02
Total	0.9884	1.288	1.122	0.3414	0.9349
ORGP Sediment	0.9429E-01	0.2046	0.2167	0.6459E-01	0.1450
Total P Loss (lb/a)	1.083	1.493	1.339	0.4060	1.080
Atm Depn. NO3 (lb/a)	8.048	8.526	8.925	7.696	8.299
Atm Depn. NH4 (lb/a)	1.955	2.289	2.420	1.698	2.091
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	87.08	88.53	85.12	87.21	86.99
Nitrate appln.(lb/a)	23.33	23.81	22.67	23.37	23.30
ORGN appln.(lb/a)	21.12	21.12	21.12	21.12	21.12
Total N appln.(lb/a)	131.5	133.5	128.9	131.7	131.4
PO4-p appln.(lb/a)	24.41	25.24	24.62	24.67	24.74
ORGP appln.(lb/a)	4.500	4.500	4.500	4.500	4.500
Total P appln.(lb/a)	28.91	29.74	29.12	29.17	29.24
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.2100E-01	0.3500E-01	0.2600E-01	0.1200E-01	0.2350E-01
Upper	68.65	74.64	66.07	69.50	69.71
Lower	46.70	32.70	38.31	52.55	42.56
Total	115.4	107.4	104.4	122.1	112.3
Phosphorus					
Surface	0.1700E-01	0.2900E-01	0.2300E-01	0.1200E-01	0.2025E-01
Upper	16.75	15.50	15.57	18.91	16.68
Lower	0.3450	0.4690	0.3880	0.2310	0.3583
Total	17.12	16.00	15.98	19.15	17.06
Deficit (lb/a)					
Nitrogen					
Surface	1.330	1.315	1.325	1.338	1.327
Upper	12.14	6.130	14.71	11.26	11.06
Lower	6.359	20.35	14.73	0.5031	10.49
Total	19.83	27.79	30.77	13.10	22.87
Phosphorus					
Surface	1.384	1.371	1.378	1.389	1.381
Upper	5.664	6.912	6.842	3.500	5.729
Lower	3.858	3.733	3.814	3.971	3.844
Total	10.91	12.02	12.03	8.860	10.95
Other Fluxes-lb/ac					
N Mineralization	32.76	29.54	27.70	37.97	31.99
P Mineralization	0.9117	0.8432	0.9044	0.9609	0.9050
Denitrification	0.5702	0.3394	0.5747	1.415	0.7248
N Immobilization	13.92	12.30	11.82	13.53	12.89
P Immobilization	7.467	8.980	8.725	5.005	7.544

AGCHEM RESULTS FOR WEST BRANCH SUSQUEHANNA (HAY), SEGMENT 66

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	50.29	36.74	42.44	37.48	41.74
Runoff (in)					
Surface	12.31	5.137	7.739	6.065	7.813
Interflow	8.830	5.494	7.198	5.526	6.762
Baseflow	8.135	6.262	6.950	6.220	6.892
Total	29.27	16.89	21.89	17.81	21.47
Sediment Loss (t/a)	0.4530	0.8470E-01	0.1740	0.1100	0.2054
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	1.088	0.7047	0.3996	0.6949	0.7218
Interflow	5.344	3.271	4.342	5.972	4.732
Baseflow	10.27	9.204	10.46	9.996	9.982
Total	16.71	13.18	15.20	16.66	15.44
NH3 Loss					
Surface	1.487	0.8108	0.3905	0.7815	0.8675
Interflow	0.5266	0.4345	0.3732	0.6269	0.4903
Baseflow	0.7840E-01	0.4287E-01	0.3891E-01	0.3039E-01	0.4764E-01
Sediment	0.5006E-02	0.8419E-03	0.1672E-02	0.1209E-02	0.2182E-02
Total	2.097	1.289	0.8043	1.440	1.408
ORGN Sediment	1.169	0.1969	0.4248	0.2575	0.5120
Total N Loss (lb/a)	19.97	14.67	16.43	18.36	17.36
PO4 Loss					
Surface	0.8239	0.3337	0.4981	0.8416	0.6243
Interflow	0.3092	0.1448	0.1460	0.1673	0.1918
Baseflow	0.1972E-02	0.9139E-04	0.8090E-04	0.4410E-04	0.5471E-03
Sediment	0.1876E-01	0.3315E-02	0.6753E-02	0.5005E-02	0.8458E-02
Total	1.154	0.4819	0.6509	1.014	0.8252
ORGP Sediment	0.3127	0.5284E-01	0.1139	0.6926E-01	0.1372
Total P Loss (lb/a)	1.467	0.5348	0.7647	1.083	0.9624
Atm Depn. NO3 (lb/a)	9.127	8.393	8.786	8.481	8.697
Atm Depn. NH4 (lb/a)	2.574	2.101	2.361	2.238	2.318
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	21.76	21.95	22.51	22.17	22.10
Nitrate appln.(lb/a)	7.260	7.323	7.510	7.397	7.373
ORGN appln.(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Total N appln.(lb/a)	29.02	29.27	30.02	29.57	29.47
PO4-p appln.(lb/a)	10.97	11.07	11.40	11.28	11.18
ORGP appln.(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Total P appln.(lb/a)	10.97	11.07	11.40	11.28	11.18
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.1100E-01	0.5000E-02	0.6000E-02	0.7000E-02	0.7250E-02
Upper	21.50	25.29	25.12	20.91	23.21
Lower	17.68	17.68	17.68	17.68	17.68
Total	39.20	42.98	42.81	38.60	40.90
Phosphorus					
Surface	0.1600E-01	0.9000E-02	0.9000E-02	0.1000E-01	0.1100E-01
Upper	9.852	9.779	9.284	8.842	9.439
Lower	2.252	2.251	2.251	2.251	2.251
Total	12.12	12.04	11.54	11.10	11.70
Deficit (lb/a)					
Nitrogen					
Surface	0.4396	0.4448	0.4443	0.4437	0.4431
Upper	5.424	1.642	1.802	6.012	3.720
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	5.863	2.086	2.247	6.456	4.163
Phosphorus					
Surface	0.7344	0.7415	0.7414	0.7399	0.7393
Upper	2.159	2.227	2.722	3.165	2.568
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	2.894	2.968	3.463	3.905	3.307
Other Fluxes-lb/ac					
N Mineralization	26.90	27.24	27.72	26.58	27.11
P Mineralization	1.138	1.039	1.044	1.044	1.066
Denitrification	2.151	2.431	2.505	2.550	2.409
N Immobilization	6.242	7.137	7.537	7.231	7.037
P Immobilization	2.395	1.966	1.985	2.306	2.163

AGCHEM RESULTS FOR WEST BRANCH SUSQUEHANNA (HAY), SEGMENT 66

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	32.93	37.44	48.26	32.01	37.66
Runoff (in)					
Surface	4.488	6.887	8.659	3.827	5.965
Interflow	4.674	6.911	9.580	5.820	6.746
Baseflow	5.244	6.867	8.557	5.542	6.552
Total	14.41	20.66	26.80	15.19	19.26
Sediment Loss (t/a)	0.7320E-01	0.1240	0.1440	0.4398E-01	0.9629E-01
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.3254	0.6491	0.6266	0.3791	0.4950
Interflow	3.526	3.863	6.189	2.985	4.141
Baseflow	9.593	10.87	11.29	7.804	9.889
Total	13.44	15.38	18.11	11.17	14.52
NH3 Loss					
Surface	0.4066	0.7517	0.6790	0.2783	0.5289
Interflow	0.3284	0.4720	0.5955	0.2169	0.4032
Baseflow	0.2373E-01	0.2933E-01	0.3481E-01	0.2170E-01	0.2739E-01
Sediment	0.7314E-03	0.1211E-02	0.1318E-02	0.3562E-03	0.9042E-03
Total	0.7594	1.254	1.311	0.5172	0.9604
ORGN Sediment	0.1710	0.2899	0.3275	0.9019E-01	0.2196
Total N Loss (lb/a)	14.38	16.92	19.75	11.78	15.71
PO4 Loss					
Surface	0.3569	0.5446	0.7965	0.2674	0.4913
Interflow	0.1041	0.1228	0.1949	0.9514E-01	0.1292
Baseflow	0.2295E-04	0.1324E-04	0.4713E-05	0.1273E-05	0.1054E-04
Sediment	0.3036E-02	0.4827E-02	0.5773E-02	0.1432E-02	0.3767E-02
Total	0.4641	0.6723	0.9972	0.3640	0.6244
ORGP Sediment	0.4597E-01	0.7806E-01	0.8863E-01	0.2420E-01	0.5922E-01
Total P Loss (lb/a)	0.5101	0.7503	1.086	0.3882	0.6837
Atm Depn. NO3 (lb/a)	8.048	8.526	8.925	7.696	8.299
Atm Depn. NH4 (lb/a)	1.955	2.289	2.420	1.698	2.091
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	22.51	22.51	22.51	22.51	22.51
Nitrate appln.(lb/a)	7.510	7.510	7.510	7.510	7.510
ORGN appln.(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Total N appln.(lb/a)	30.02	30.02	30.02	30.02	30.02
PO4-p appln.(lb/a)	11.40	11.40	11.40	11.40	11.40
ORGP appln.(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Total P appln.(lb/a)	11.40	11.40	11.40	11.40	11.40
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.4000E-02	0.1000E-01	0.7000E-02	0.4000E-02	0.6250E-02
Upper	24.25	25.99	22.55	26.18	24.74
Lower	17.68	17.68	17.68	17.68	17.68
Total	41.93	43.69	40.24	43.86	42.43
Phosphorus					
Surface	0.6000E-02	0.1500E-01	0.1000E-01	0.5000E-02	0.9000E-02
Upper	8.820	8.627	10.40	7.084	8.733
Lower	2.252	2.251	1.840	0.3800	1.681
Total	11.08	10.89	12.25	7.469	10.42
Deficit (lb/a)					
Nitrogen					
Surface	0.4466	0.4401	0.4432	0.4467	0.4442
Upper	2.687	0.9345	4.371	0.7594	2.188
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	3.134	1.375	4.814	1.206	2.632
Phosphorus					
Surface	0.7450	0.7350	0.7402	0.7450	0.7413
Upper	3.189	3.381	1.610	4.922	3.275
Lower	0.0000	0.0000	0.4110	1.871	0.5705
Total	3.934	4.116	2.761	7.538	4.587
Other Fluxes-lb/ac					
N Mineralization	29.40	27.38	26.58	29.24	28.15
P Mineralization	1.084	1.014	0.9860	0.6440	0.9320
Denitrification	3.018	2.484	2.312	2.406	2.555
N Immobilization	8.302	7.412	7.322	8.009	7.761
P Immobilization	2.376	2.201	1.887	2.350	2.203

AGCHEM RESULTS FOR WEST BRANCH SUSQUEHANNA (HI-TILL), SEGMENT 72

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	45.85	35.21	45.00	35.72	40.44
Runoff (in)					
Surface	7.086	2.811	6.391	3.625	4.978
Interflow	7.664	3.619	7.385	5.078	5.936
Baseflow	9.438	6.834	8.828	7.440	8.135
Total	24.19	13.26	22.60	16.14	19.05
Sediment Loss (t/a)	1.090	0.4260	0.7370	0.4010	0.6635
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.5328	0.2256	0.3999	0.3105	0.3672
Interflow	14.52	5.258	6.906	5.223	7.977
Baseflow	7.201	5.464	7.683	5.840	6.547
Total	22.25	10.95	14.99	11.37	14.89
NH3 Loss					
Surface	1.104	0.4996	0.9228	0.8773	0.8509
Interflow	1.488	0.8382	2.947	1.665	1.735
Baseflow	0.6829E-01	0.3126E-01	0.3229E-01	0.2268E-01	0.3863E-01
Sediment	0.1275E-01	0.4643E-02	0.8269E-02	0.4533E-02	0.7549E-02
Total	2.672	1.374	3.910	2.569	2.631
ORGN Sediment	3.527	1.368	2.404	1.275	2.143
Total N Loss (lb/a)	28.45	13.69	21.30	15.22	19.66
PO4 Loss					
Surface	0.2511	0.2302	0.4618	0.2674	0.3026
Interflow	0.3566	0.1132	0.2841	0.9765E-01	0.2129
Baseflow	0.1951E-02	0.8393E-04	0.6744E-04	0.1435E-04	0.5292E-03
Sediment	0.4608E-01	0.1925E-01	0.3379E-01	0.1790E-01	0.2925E-01
Total	0.6557	0.3627	0.7798	0.3829	0.5453
ORGP Sediment	0.9773	0.3794	0.6656	0.3536	0.5940
Total P Loss (lb/a)	1.633	0.7420	1.445	0.7365	1.139
Atm Depn. NO3 (lb/a)	8.423	7.795	8.222	7.576	8.004
Atm Depn. NH4 (lb/a)	2.360	2.035	2.249	1.909	2.138
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	72.45	74.42	74.42	74.42	73.93
Nitrate appln.(lb/a)	19.01	19.67	19.67	19.67	19.51
ORGN appln.(lb/a)	19.14	19.14	19.14	19.14	19.14
Total N appln.(lb/a)	110.6	113.2	113.2	113.2	112.6
PO4-p appln.(lb/a)	20.17	21.31	21.31	21.31	21.02
ORGP appln.(lb/a)	4.020	4.020	4.020	4.020	4.020
Total P appln.(lb/a)	24.19	25.33	25.33	25.33	25.04
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.1800E-01	0.8000E-02	0.9000E-02	0.1400E-01	0.1225E-01
Upper	53.22	66.49	63.26	65.65	62.15
Lower	40.23	47.16	47.16	47.16	45.43
Total	93.47	113.7	110.4	112.8	107.6
Phosphorus					
Surface	0.1500E-01	0.6000E-02	0.8000E-02	0.1100E-01	0.1000E-01
Upper	15.23	17.26	16.22	17.17	16.47
Lower	3.753	3.752	3.752	3.753	3.753
Total	18.99	21.02	19.98	20.93	20.23
Deficit (lb/a)					
Nitrogen					
Surface	1.183	1.193	1.191	1.187	1.189
Upper	18.60	5.343	8.543	6.165	9.663
Lower	6.934	0.0000	0.0000	0.0000	1.734
Total	26.72	6.536	9.734	7.352	12.59
Phosphorus					
Surface	1.236	1.245	1.243	1.239	1.241
Upper	4.801	2.756	3.794	2.844	3.549
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	6.037	4.001	5.037	4.083	4.790
Other Fluxes-lb/ac					
N Mineralization	29.16	38.35	35.68	37.47	35.17
P Mineralization	1.283	1.161	1.162	1.181	1.197
Denitrification	1.389	2.258	2.205	2.125	1.994
N Immobilization	9.639	11.77	11.12	11.02	10.89
P Immobilization	6.181	5.234	4.953	4.395	5.191

AGCHEM RESULTS FOR WEST BRANCH SUSQUEHANNA (HI-TILL), SEGMENT 72

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	36.64	38.39	50.41	34.96	40.10
Runoff (in)					
Surface	4.901	5.591	8.224	4.584	5.825
Interflow	5.065	6.363	8.690	4.815	6.233
Baseflow	6.472	8.288	10.32	6.660	7.934
Total	16.44	20.24	27.23	16.06	19.99
Sediment Loss (t/a)	0.6740	0.7560	1.580	0.6920	0.9255
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.3772	0.9770	0.6304	0.5710	0.6389
Interflow	9.931	15.37	14.77	2.551	10.66
Baseflow	5.379	4.610	3.159	3.019	4.042
Total	15.69	20.96	18.55	6.142	15.34
NH3 Loss					
Surface	1.104	2.764	2.630	1.046	1.886
Interflow	2.309	3.058	2.997	1.398	2.440
Baseflow	0.1768E-01	0.2149E-01	0.2603E-01	0.1595E-01	0.2029E-01
Sediment	0.7355E-02	0.1093E-01	0.2056E-01	0.7834E-02	0.1167E-01
Total	3.438	5.855	5.673	2.468	4.359
ORGN Sediment	2.187	2.456	5.148	2.256	3.012
Total N Loss (lb/a)	21.31	29.27	29.38	10.87	22.71
PO4 Loss					
Surface	0.4231	0.5629	0.6513	0.2391	0.4691
Interflow	0.2522	0.3859	0.3483	0.9109E-01	0.2694
Baseflow	0.1314E-05	0.1530E-05	0.1086E-05	0.6426E-06	0.1143E-05
Sediment	0.3141E-01	0.3543E-01	0.7303E-01	0.3097E-01	0.4271E-01
Total	0.7067	0.9842	1.073	0.3611	0.7813
ORGP Sediment	0.6057	0.6813	1.430	0.6250	0.8355
Total P Loss (lb/a)	1.312	1.665	2.503	0.9862	1.617
Atm Depn. NO3 (lb/a)	7.549	7.930	8.490	7.365	7.833
Atm Depn. NH4 (lb/a)	1.909	2.187	2.351	1.741	2.047
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	72.54	67.84	71.31	73.68	71.34
Nitrate appln.(lb/a)	19.04	17.48	18.64	19.42	18.64
ORGN appln.(lb/a)	19.14	19.14	19.14	19.14	19.14
Total N appln.(lb/a)	110.7	104.5	109.1	112.2	109.1
PO4-p appln.(lb/a)	20.22	21.31	20.46	21.31	20.83
ORGP appln.(lb/a)	4.020	4.020	4.020	4.020	4.020
Total P appln.(lb/a)	24.24	25.33	24.48	25.33	24.85
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.6000E-02	0.1400E-01	0.1400E-01	0.6000E-02	0.1000E-01
Upper	55.12	56.69	59.38	66.12	59.33
Lower	47.17	33.43	34.77	47.16	40.63
Total	102.3	90.13	94.16	113.3	99.97
Phosphorus					
Surface	0.6000E-02	0.1200E-01	0.1200E-01	0.5000E-02	0.8750E-02
Upper	16.01	15.70	15.61	17.12	16.11
Lower	0.9410	0.4990	0.4210	0.3070	0.5420
Total	16.95	16.21	16.04	17.43	16.66
Deficit (lb/a)					
Nitrogen					
Surface	1.195	1.187	1.187	1.194	1.191
Upper	16.70	15.12	12.45	5.696	12.49
Lower	0.0000	13.73	12.39	0.0000	6.530
Total	17.89	30.03	26.03	6.890	20.21
Phosphorus					
Surface	1.245	1.239	1.239	1.246	1.242
Upper	4.010	4.315	4.402	2.892	3.905
Lower	2.812	3.253	3.331	3.445	3.210
Total	8.067	8.808	8.973	7.582	8.358
Other Fluxes-lb/ac					
N Mineralization	34.48	28.55	27.23	35.96	31.56
P Mineralization	0.8817	0.8086	0.8573	0.8393	0.8467
Denitrification	1.723	1.061	0.5859	1.081	1.113
N Immobilization	11.41	9.243	9.772	11.98	10.60
P Immobilization	3.896	5.322	4.761	3.388	4.342

AGCHEM RESULTS FOR WEST BRANCH SUSQUEHANNA (LOW-TILL), SEGMENT 73

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	45.85	35.21	45.00	35.72	40.44
Runoff (in)					
Surface	5.606	2.058	5.059	2.743	3.866
Interflow	7.803	3.443	7.393	4.993	5.908
Baseflow	9.813	6.974	9.331	7.777	8.474
Total	23.22	12.48	21.78	15.51	18.25
Sediment Loss (t/a)	0.6710	0.2710	0.4660	0.2490	0.4143
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.3981	0.1332	0.2448	0.2060	0.2455
Interflow	16.81	5.176	6.983	5.101	8.517
Baseflow	6.372	4.916	8.605	5.525	6.355
Total	23.58	10.23	15.83	10.83	15.12
NH3 Loss					
Surface	0.9213	0.4111	0.9084	0.6793	0.7300
Interflow	1.248	0.7005	2.874	1.687	1.627
Baseflow	0.6934E-01	0.3010E-01	0.3216E-01	0.2209E-01	0.3842E-01
Sediment	0.7519E-02	0.2911E-02	0.5064E-02	0.2769E-02	0.4566E-02
Total	2.247	1.145	3.820	2.391	2.401
ORGN Sediment	2.696	1.084	1.865	0.9950	1.660
Total N Loss (lb/a)	28.52	12.45	21.52	14.22	19.18
PO4 Loss					
Surface	0.2861	0.3007	0.5546	0.2832	0.3562
Interflow	0.3317	0.8723E-01	0.2349	0.7350E-01	0.1818
Baseflow	0.1960E-02	0.7453E-04	0.4847E-04	0.5150E-05	0.5220E-03
Sediment	0.2792E-01	0.1222E-01	0.2133E-01	0.1134E-01	0.1820E-01
Total	0.6477	0.4002	0.8109	0.3681	0.5567
ORGP Sediment	0.7187	0.2888	0.4969	0.2652	0.4424
Total P Loss (lb/a)	1.366	0.6890	1.308	0.6333	0.9991
Atm Depn. NO3 (lb/a)	8.423	7.795	8.222	7.576	8.004
Atm Depn. NH4 (lb/a)	2.360	2.035	2.249	1.909	2.138
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	79.37	81.70	81.70	81.70	81.12
Nitrate appln.(lb/a)	20.91	21.69	21.69	21.69	21.50
ORGN appln.(lb/a)	20.46	20.46	20.46	20.46	20.46
Total N appln.(lb/a)	120.7	123.9	123.9	123.9	123.1
PO4-p appln.(lb/a)	21.94	23.29	23.29	23.29	22.95
ORGP appln.(lb/a)	4.320	4.320	4.320	4.320	4.320
Total P appln.(lb/a)	26.26	27.61	27.61	27.61	27.27
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.3200E-01	0.1100E-01	0.1400E-01	0.1600E-01	0.1825E-01
Upper	60.75	74.29	68.75	74.95	69.69
Lower	40.63	51.10	51.10	51.08	48.48
Total	101.4	125.4	119.9	126.1	118.2
Phosphorus					
Surface	0.2900E-01	0.8000E-02	0.1400E-01	0.1400E-01	0.1625E-01
Upper	16.05	17.35	16.15	17.67	16.81
Lower	4.203	4.202	4.202	2.558	3.791
Total	20.28	21.56	20.37	20.24	20.61
Deficit (lb/a)					
Nitrogen					
Surface	1.269	1.289	1.286	1.285	1.282
Upper	17.07	3.518	9.033	2.833	8.113
Lower	10.47	0.0000	0.0000	0.0000	2.617
Total	28.81	4.807	10.32	4.118	12.01
Phosphorus					
Surface	1.372	1.392	1.387	1.386	1.384
Upper	6.381	5.075	6.261	4.748	5.616
Lower	0.0000	0.0000	0.0000	1.644	0.4110
Total	7.753	6.468	7.648	7.779	7.412
Other Fluxes-lb/ac					
N Mineralization	30.45	41.37	38.71	40.65	37.80
P Mineralization	1.406	1.200	1.246	1.085	1.234
Denitrification	1.176	2.002	2.438	1.899	1.879
N Immobilization	10.93	13.16	12.52	12.43	12.26
P Immobilization	8.126	6.861	6.928	5.905	6.955

AGCHEM RESULTS FOR WEST BRANCH SUSQUEHANNA (LOW-TILL), SEGMENT 73

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	36.64	38.39	50.41	34.96	40.10
Runoff (in)					
Surface	3.772	4.521	6.765	3.248	4.576
Interflow	5.025	6.362	8.845	5.039	6.318
Baseflow	6.768	8.788	10.93	7.053	8.384
Total	15.57	19.67	26.53	15.34	19.28
Sediment Loss (t/a)	0.4220	0.5090	1.080	0.3040	0.5788
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.3280	0.7642	0.4795	0.2502	0.4555
Interflow	11.00	17.32	17.40	3.474	12.30
Baseflow	3.664	2.106	3.207	2.069	2.761
Total	14.99	20.19	21.09	5.794	15.52
NH3 Loss					
Surface	0.8213	2.962	2.468	1.002	1.813
Interflow	2.252	2.905	2.898	1.548	2.401
Baseflow	0.1711E-01	0.2025E-01	0.2405E-01	0.1459E-01	0.1900E-01
Sediment	0.4539E-02	0.7312E-02	0.1505E-01	0.3207E-02	0.7527E-02
Total	3.095	5.894	5.405	2.568	4.241
ORGN Sediment	1.700	2.071	4.399	1.210	2.345
Total N Loss (lb/a)	19.78	28.16	30.89	9.572	22.10
PO4 Loss					
Surface	0.5617	0.7987	0.8608	0.2735	0.6237
Interflow	0.2509	0.4057	0.3366	0.7268E-01	0.2665
Baseflow	0.9109E-06	0.1444E-05	0.9439E-06	0.3873E-06	0.9215E-06
Sediment	0.2026E-01	0.2514E-01	0.5062E-01	0.1331E-01	0.2733E-01
Total	0.8329	1.230	1.248	0.3595	0.9176
ORGP Sediment	0.4529	0.5531	1.177	0.3226	0.6264
Total P Loss (lb/a)	1.286	1.783	2.425	0.6821	1.544
Atm Depn. NO3 (lb/a)	7.549	7.930	8.490	7.365	7.833
Atm Depn. NH4 (lb/a)	1.909	2.187	2.351	1.741	2.047
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	79.48	73.92	78.03	81.35	78.19
Nitrate appln.(lb/a)	20.95	19.10	20.47	21.57	20.52
ORGN appln.(lb/a)	20.46	20.46	20.46	20.46	20.46
Total N appln.(lb/a)	120.9	113.5	119.0	123.4	119.2
PO4-p appln.(lb/a)	22.01	23.29	22.29	23.29	22.72
ORGP appln.(lb/a)	4.320	4.320	4.320	4.320	4.320
Total P appln.(lb/a)	26.33	27.61	26.61	27.61	27.04
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.1500E-01	0.2600E-01	0.2600E-01	0.1100E-01	0.1950E-01
Upper	65.94	61.21	65.72	77.28	67.54
Lower	48.14	31.67	34.55	47.21	40.39
Total	114.1	92.90	100.3	124.5	108.0
Phosphorus					
Surface	0.1400E-01	0.2300E-01	0.2400E-01	0.1000E-01	0.1775E-01
Upper	16.58	15.71	15.27	19.19	16.69
Lower	0.3770	0.4570	0.3770	0.2420	0.3632
Total	16.97	16.19	15.67	19.45	17.07
Deficit (lb/a)					
Nitrogen					
Surface	1.286	1.275	1.275	1.289	1.281
Upper	11.85	16.60	12.06	0.5044	10.25
Lower	2.969	19.44	16.53	3.873	10.70
Total	16.10	37.31	29.86	5.666	22.23
Phosphorus					
Surface	1.387	1.378	1.376	1.391	1.383
Upper	5.836	6.703	7.145	3.217	5.725
Lower	3.826	3.745	3.825	3.961	3.839
Total	11.05	11.83	12.35	8.568	10.95
Other Fluxes-lb/ac					
N Mineralization	34.31	26.63	28.16	37.22	31.58
P Mineralization	0.9062	0.8417	0.9122	0.8956	0.8889
Denitrification	1.034	0.4527	0.5640	0.5858	0.6591
N Immobilization	12.85	10.09	10.99	13.55	11.87
P Immobilization	5.375	6.867	6.616	4.146	5.751

AGCHEM RESULTS FOR WEST BRANCH SUSQUEHANNA (HAY), SEGMENT 76

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	45.85	35.21	45.00	35.72	40.44
Runoff (in)					
Surface	8.382	3.390	7.356	4.415	5.886
Interflow	8.036	4.227	7.797	5.628	6.422
Baseflow	9.227	6.625	8.677	7.172	7.925
Total	25.65	14.24	23.83	17.22	20.23
Sediment Loss (t/a)	0.4810	0.1040	0.2760	0.1600	0.2553
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.7472	0.2910	0.3882	0.5342	0.4901
Interflow	4.488	2.931	3.805	4.959	4.046
Baseflow	9.442	8.512	11.02	10.07	9.761
Total	14.68	11.73	15.21	15.57	14.30
NH3 Loss					
Surface	2.435	1.248	0.4227	0.8075	1.228
Interflow	0.6138	0.4551	0.4352	0.5999	0.5260
Baseflow	0.6791E-01	0.3173E-01	0.3232E-01	0.2266E-01	0.3866E-01
Sediment	0.5871E-02	0.1095E-02	0.2822E-02	0.1758E-02	0.2887E-02
Total	3.122	1.736	0.8931	1.432	1.796
ORGN Sediment	1.261	0.2564	0.7061	0.4060	0.6574
Total N Loss (lb/a)	19.06	13.73	16.81	17.41	16.75
PO4 Loss					
Surface	1.132	0.5492	0.6253	0.6819	0.7471
Interflow	0.4341	0.1546	0.1408	0.1936	0.2308
Baseflow	0.1960E-02	0.1132E-03	0.1335E-03	0.7227E-04	0.5697E-03
Sediment	0.2236E-01	0.4269E-02	0.1187E-01	0.7201E-02	0.1143E-01
Total	1.591	0.7082	0.7782	0.8828	0.9901
ORGP Sediment	0.3386	0.6889E-01	0.1903	0.1096	0.1768
Total P Loss (lb/a)	1.929	0.7771	0.9684	0.9924	1.167
Atm Depn. NO3 (lb/a)	8.423	7.795	8.222	7.576	8.004
Atm Depn. NH4 (lb/a)	2.360	2.035	2.249	1.909	2.138
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	21.76	21.95	22.51	22.17	22.10
Nitrate appln.(lb/a)	7.260	7.323	7.510	7.397	7.373
ORGN appln.(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Total N appln.(lb/a)	29.02	29.27	30.02	29.57	29.47
PO4-p appln.(lb/a)	12.57	12.68	13.00	12.81	12.76
ORGP appln.(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Total P appln.(lb/a)	12.57	12.68	13.00	12.81	12.76
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.9000E-02	0.3000E-02	0.4000E-02	0.5000E-02	0.5250E-02
Upper	20.64	24.89	23.94	18.80	22.07
Lower	17.68	17.68	17.68	17.68	17.68
Total	38.33	42.58	41.63	36.49	39.76
Phosphorus					
Surface	0.1400E-01	0.5000E-02	0.6000E-02	0.8000E-02	0.8250E-02
Upper	10.20	11.35	10.55	10.02	10.53
Lower	2.252	2.251	2.251	2.251	2.251
Total	12.47	13.61	12.81	12.28	12.79
Deficit (lb/a)					
Nitrogen					
Surface	0.4413	0.4471	0.4461	0.4448	0.4448
Upper	6.289	2.037	2.979	8.121	4.857
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	6.730	2.484	3.425	8.566	5.301
Phosphorus					
Surface	0.7363	0.7456	0.7444	0.7425	0.7422
Upper	1.813	0.6547	1.458	1.991	1.479
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	2.549	1.400	2.202	2.733	2.221
Other Fluxes-lb/ac					
N Mineralization	26.61	26.92	27.67	26.20	26.85
P Mineralization	1.194	1.067	1.106	1.059	1.107
Denitrification	2.346	3.009	3.091	3.171	2.904
N Immobilization	5.769	6.927	7.593	7.025	6.828
P Immobilization	3.443	2.424	2.356	2.728	2.738

AGCHEM RESULTS FOR WEST BRANCH SUSQUEHANNA (HAY), SEGMENT 76

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	36.64	38.39	50.41	34.96	40.10
Runoff (in)					
Surface	5.859	6.625	9.622	5.260	6.842
Interflow	5.348	6.761	9.243	5.034	6.596
Baseflow	6.207	8.035	9.868	6.565	7.669
Total	17.41	21.42	28.73	16.86	21.11
Sediment Loss (t/a)	0.2760	0.2950	0.5200	0.1390	0.3075
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.5036	0.5194	0.4979	0.4304	0.4878
Interflow	3.446	4.351	4.915	2.631	3.836
Baseflow	10.24	11.53	11.91	8.475	10.54
Total	14.19	16.41	17.32	11.54	14.86
NH3 Loss					
Surface	0.6877	0.6614	0.5150	0.2797	0.5360
Interflow	0.5529	0.6198	0.5171	0.2316	0.4803
Baseflow	0.1812E-01	0.2206E-01	0.2578E-01	0.1640E-01	0.2059E-01
Sediment	0.2919E-02	0.3192E-02	0.5449E-02	0.1363E-02	0.3231E-02
Total	1.262	1.306	1.063	0.5290	1.040
ORGN Sediment	0.7219	0.7747	1.370	0.3499	0.8041
Total N Loss (lb/a)	16.17	18.49	19.76	12.42	16.71
PO4 Loss					
Surface	0.6192	0.7818	1.079	0.3142	0.6985
Interflow	0.1321	0.1810	0.1898	0.9503E-01	0.1495
Baseflow	0.4238E-04	0.3198E-04	0.1821E-04	0.3573E-05	0.2404E-04
Sediment	0.1269E-01	0.1328E-01	0.2396E-01	0.5964E-02	0.1397E-01
Total	0.7641	0.9761	1.293	0.4152	0.8621
ORGP Sediment	0.1950	0.2104	0.3709	0.9646E-01	0.2182
Total P Loss (lb/a)	0.9591	1.186	1.664	0.5117	1.080
Atm Depn. NO3 (lb/a)	7.549	7.930	8.490	7.365	7.833
Atm Depn. NH4 (lb/a)	1.909	2.187	2.351	1.741	2.047
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	22.51	22.51	22.51	22.51	22.51
Nitrate appln.(lb/a)	7.510	7.510	7.510	7.510	7.510
ORGN appln.(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Total N appln.(lb/a)	30.02	30.02	30.02	30.02	30.02
PO4-p appln.(lb/a)	13.00	13.00	13.00	13.00	13.00
ORGP appln.(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Total P appln.(lb/a)	13.00	13.00	13.00	13.00	13.00
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.3000E-02	0.7000E-02	0.8000E-02	0.3000E-02	0.5250E-02
Upper	21.51	23.41	22.92	23.88	22.93
Lower	17.68	17.68	17.68	17.68	17.68
Total	39.20	41.10	40.62	41.57	40.62
Phosphorus					
Surface	0.5000E-02	0.1000E-01	0.1100E-01	0.5000E-02	0.7750E-02
Upper	10.27	9.216	11.17	9.248	9.978
Lower	2.252	2.251	2.251	1.824	2.145
Total	12.53	11.48	13.43	11.08	12.13
Deficit (lb/a)					
Nitrogen					
Surface	0.4471	0.4431	0.4420	0.4472	0.4449
Upper	5.421	3.508	4.009	3.036	3.993
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	5.868	3.951	4.451	3.484	4.438
Phosphorus					
Surface	0.7458	0.7404	0.7392	0.7452	0.7427
Upper	1.735	2.792	0.8393	2.758	2.031
Lower	0.0000	0.0000	0.0000	0.4270	0.1067
Total	2.481	3.532	1.579	3.930	2.881
Other Fluxes-lb/ac					
N Mineralization	28.23	27.01	27.04	28.91	27.80
P Mineralization	1.109	1.040	1.178	0.9193	1.062
Denitrification	3.703	3.284	3.036	3.193	3.304
N Immobilization	7.803	7.159	7.505	8.064	7.633
P Immobilization	2.556	2.585	2.153	2.841	2.534

Percent of Total Load Contributed from Each Land Use in West Branch Susquehanna Basin

Segment 50

		Pervious						Impervious		Point	Total
		FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Source	Load
NH3											
	84	13.65	9.67	2.51	3.37	3.96	8.46	1.60	0.93	55.86	100.00
	85	13.74	7.27	1.67	3.16	2.61	7.49	1.55	0.95	61.57	100.00
	86	13.59	10.69	2.63	3.09	2.56	4.54	1.89	1.00	60.02	100.00
	87	10.26	19.32	6.46	2.35	2.04	6.51	1.20	0.83	51.01	100.00
	88	12.40	11.67	2.36	2.75	2.09	4.44	1.39	1.01	61.90	100.00
	89	10.91	16.52	5.00	2.33	1.75	10.37	1.17	0.70	51.22	100.00
	90	14.32	12.68	3.66	3.23	2.71	4.72	1.57	0.89	56.22	100.00
	91	11.98	7.06	2.13	2.52	1.66	2.43	1.27	0.98	69.97	100.00
MEAN		12.54	12.22	3.44	2.84	2.41	6.29	1.44	0.90	57.91	100.00
NO3											
	84	42.34	11.08	3.15	16.52	12.61	11.92	0.09	0.43	1.87	100.00
	85	48.03	6.05	1.61	16.96	11.91	12.93	0.08	0.43	1.99	100.00
	86	46.98	6.88	2.47	16.22	11.66	13.18	0.11	0.47	2.02	100.00
	87	41.39	9.51	3.15	16.57	11.79	14.75	0.09	0.51	2.25	100.00
	88	44.38	9.42	2.61	16.10	11.06	13.79	0.08	0.47	2.10	100.00
	89	42.15	9.37	2.82	16.74	11.71	13.60	0.08	0.41	3.12	100.00
	90	46.39	8.06	2.58	16.57	11.85	11.54	0.08	0.39	2.54	100.00
	91	50.20	5.01	1.33	16.42	11.05	11.81	0.08	0.49	3.61	100.00
MEAN		45.23	8.22	2.48	16.52	11.73	12.87	0.09	0.45	2.43	100.00
ORGN											
	84	38.02	4.92	0.89	11.29	22.46	2.11	11.79	4.07	4.43	100.00
	85	31.90	4.81	0.84	11.07	16.77	1.80	18.25	6.72	7.82	100.00
	86	36.06	6.29	1.15	10.62	13.89	2.57	17.75	5.61	6.05	100.00
	87	31.97	4.37	0.75	11.17	17.32	1.88	17.37	7.25	7.93	100.00
	88	24.60	3.39	0.58	10.26	16.00	1.38	22.89	9.86	11.03	100.00
	89	26.68	3.46	0.62	10.05	14.79	1.31	21.26	7.66	14.17	100.00
	90	33.17	4.44	0.74	11.32	16.61	1.92	16.85	5.74	9.21	100.00
	91	21.49	2.36	0.33	8.33	10.99	0.73	24.28	11.18	20.32	100.00
MEAN		32.12	4.52	0.79	10.73	16.87	1.85	17.65	6.59	8.90	100.00
TN											
	84	37.08	10.03	2.75	13.70	12.46	10.06	2.21	0.98	10.73	100.00
	85	41.01	6.13	1.55	14.19	10.76	11.10	2.18	1.02	12.07	100.00
	86	40.17	7.41	2.35	13.42	10.35	10.60	2.70	1.09	11.90	100.00
	87	34.00	11.06	3.62	13.11	10.20	11.89	2.17	1.15	12.80	100.00
	88	37.51	9.40	2.43	13.39	9.79	11.37	2.08	1.15	12.89	100.00
	89	34.50	10.41	3.11	13.25	9.82	12.04	2.11	0.97	13.78	100.00
	90	39.94	8.44	2.57	13.92	10.78	9.57	2.18	0.95	11.66	100.00
	91	41.39	5.22	1.41	13.35	9.29	9.42	2.04	1.19	16.70	100.00
MEAN		38.19	8.57	2.50	13.56	10.49	10.73	2.21	1.05	12.69	100.00
PO4											
	84	4.59	7.73	2.17	1.66	5.24	20.76	1.53	1.63	54.67	100.00
	85	4.33	6.35	1.45	1.76	2.95	16.14	1.56	1.77	63.68	100.00
	86	4.59	10.44	2.92	1.66	2.97	13.13	1.86	1.82	60.59	100.00
	87	3.79	7.63	2.01	1.47	2.78	18.30	1.40	1.80	60.82	100.00
	88	3.82	7.86	2.35	1.67	2.26	12.50	1.44	1.92	66.22	100.00
	89	4.54	8.93	2.86	1.79	2.42	26.44	1.55	1.72	49.75	100.00
	90	5.80	11.75	3.28	2.25	3.91	18.34	1.92	2.03	50.71	100.00
	91	5.17	5.88	1.47	2.15	2.13	9.11	1.73	2.46	69.92	100.00
MEAN		4.56	8.41	2.34	1.79	3.16	17.22	1.62	1.87	59.07	100.00
ORGP											
	84	30.03	7.56	1.31	8.92	17.75	3.14	10.87	3.22	17.18	100.00
	85	22.71	6.64	1.12	7.88	11.94	2.41	15.16	4.78	27.34	100.00
	86	26.56	8.99	1.59	7.82	10.24	3.57	15.25	4.13	21.87	100.00
	87	22.78	6.05	1.00	7.96	12.34	2.53	14.43	5.17	27.74	100.00
	88	16.19	4.33	0.72	6.75	10.53	1.72	17.57	6.48	35.71	100.00
	89	20.60	5.19	0.90	7.76	11.42	1.90	19.15	5.92	27.17	100.00
	90	26.96	7.02	1.13	9.21	13.50	2.94	15.98	4.66	18.59	100.00
	91	15.64	3.34	0.44	6.06	8.00	0.99	20.62	8.14	36.74	100.00
MEAN		24.01	6.56	1.11	8.02	12.62	2.60	15.40	4.93	24.77	100.00

Segment 50

		<------	------	Pervious	------	------	------>	<---Impervious->		Point	Total
		FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Source	Load
TP											
	84	13.48	7.52	1.83	4.19	9.55	14.15	6.71	2.16	40.41	100.00
	85	9.48	6.30	1.32	3.47	5.45	11.88	7.56	2.59	51.96	100.00
	86	11.51	9.72	2.42	3.60	5.22	9.75	8.55	2.51	46.71	100.00
	87	8.91	7.05	1.69	3.22	5.34	13.63	6.91	2.68	50.58	100.00
	88	6.72	6.84	1.90	2.86	4.21	9.63	7.42	2.98	57.45	100.00
	89	8.27	7.83	2.33	3.17	4.51	19.99	8.00	2.68	43.23	100.00
	90	12.36	9.95	2.51	4.40	6.85	13.00	8.86	2.81	39.25	100.00
	91	7.60	5.11	1.18	3.06	3.51	6.89	8.84	3.79	60.01	100.00
MEAN		10.09	7.68	1.93	3.55	5.83	12.61	7.80	2.71	47.80	100.00
BOD											
	84	42.57	6.53	0.79	12.65	25.15	2.90	1.43	1.37	6.62	100.00
	85	38.97	6.05	0.82	13.52	20.49	2.56	2.41	2.46	12.72	100.00
	86	44.55	7.57	0.99	13.11	17.16	3.38	2.37	2.08	8.76	100.00
	87	38.41	7.15	0.87	13.42	20.80	3.21	2.26	2.61	11.26	100.00
	88	32.16	5.69	0.82	13.41	20.92	2.72	3.24	3.86	17.20	100.00
	89	35.93	6.21	0.94	13.54	19.91	2.93	3.10	3.10	14.34	100.00
	90	41.29	6.95	0.87	14.10	20.67	3.10	2.27	2.14	8.61	100.00
	91	31.71	5.21	0.84	12.28	16.21	2.39	3.88	4.95	22.53	100.00
MEAN		39.66	6.59	0.86	13.26	20.84	2.96	2.36	2.44	11.02	100.00
SED											
	84	58.45	9.78	1.43	12.22	12.65	5.44	0.00	0.00	0.00	100.00
	85	57.42	11.69	1.67	13.53	9.69	6.00	0.00	0.00	0.00	100.00
	86	60.94	12.53	1.89	11.18	6.87	6.61	0.00	0.00	0.00	100.00
	87	51.88	12.02	1.71	15.64	11.78	6.96	0.00	0.00	0.00	100.00
	88	46.56	13.51	1.89	17.70	12.52	7.84	0.00	0.00	0.00	100.00
	89	51.09	13.09	1.93	16.13	10.62	7.15	0.00	0.00	0.00	100.00
	90	53.28	12.01	1.66	15.45	10.78	6.82	0.00	0.00	0.00	100.00
	91	42.01	16.51	2.22	20.70	9.34	9.17	0.00	0.00	0.00	100.00
MEAN		55.58	11.78	1.70	13.90	10.55	6.48	0.00	0.00	0.00	100.00

Segment 60

		<---Pervious--- FOR	HTC	LTC	PAS	URB	HAY	---><---Impervious-> ANML	RES	Point Source	Total Load
NH3											
	84	19.98	19.19	13.07	3.11	1.95	13.58	2.92	1.05	25.12	100.00
	85	19.10	13.52	9.49	2.61	1.13	12.48	2.75	1.48	37.46	100.00
	86	19.82	15.01	8.65	2.75	1.10	6.61	3.07	1.32	41.69	100.00
	87	17.90	15.36	10.58	2.53	1.04	12.95	2.64	1.44	35.58	100.00
	88	16.28	17.52	10.35	2.29	0.95	7.52	2.42	1.54	41.10	100.00
	89	17.60	21.33	16.31	2.37	0.95	9.22	2.36	1.09	28.78	100.00
	90	22.56	17.10	13.08	3.12	1.27	9.64	3.15	1.29	28.77	100.00
	91	19.97	13.83	9.48	2.68	1.07	5.65	2.81	1.73	42.77	100.00
MEAN		19.25	16.91	11.66	2.71	1.22	9.91	2.78	1.33	34.19	100.00
NO3											
	84	42.55	13.13	9.45	10.36	4.35	16.92	0.11	0.42	2.75	100.00
	85	48.32	7.97	5.27	10.33	3.95	19.48	0.11	0.57	4.00	100.00
	86	46.07	9.86	6.98	10.04	3.83	18.34	0.11	0.49	4.29	100.00
	87	38.28	12.74	8.90	9.40	3.59	22.67	0.10	0.55	3.77	100.00
	88	38.65	14.74	9.68	8.76	3.32	19.89	0.09	0.58	4.30	100.00
	89	38.82	14.36	10.23	9.87	3.77	19.00	0.10	0.46	3.38	100.00
	90	44.96	10.80	8.26	10.56	4.05	18.05	0.11	0.44	2.73	100.00
	91	50.17	7.72	5.40	10.49	3.92	17.33	0.10	0.62	4.25	100.00
MEAN		43.39	11.52	8.15	10.02	3.88	18.85	0.10	0.51	3.59	100.00
ORGN											
	84	40.89	9.21	4.49	12.97	6.83	5.42	12.57	2.22	5.40	100.00
	85	22.98	5.55	2.57	9.72	5.54	3.01	26.05	6.88	17.72	100.00
	86	27.85	7.99	4.19	9.63	3.90	4.24	22.32	4.73	15.18	100.00
	87	34.87	5.36	2.68	10.35	4.11	2.98	20.41	5.48	13.76	100.00
	88	20.88	5.10	1.96	10.63	4.84	2.90	24.86	7.75	21.09	100.00
	89	29.56	6.40	3.02	10.43	4.41	3.50	23.29	5.25	14.18	100.00
	90	30.14	5.66	2.60	11.50	5.02	3.22	25.27	5.09	11.52	100.00
	91	20.62	3.63	1.53	6.13	4.68	1.75	29.88	9.04	22.74	100.00
MEAN		31.36	6.82	3.27	10.84	5.22	3.84	20.87	4.92	12.84	100.00
TN											
	84	39.51	13.12	9.03	9.91	4.45	14.64	2.90	0.77	5.69	100.00
	85	42.58	8.42	5.55	9.29	3.71	17.27	2.93	1.16	9.11	100.00
	86	41.07	10.22	6.87	9.11	3.51	15.56	3.09	0.99	9.61	100.00
	87	35.35	12.31	8.48	8.63	3.32	19.59	2.74	1.11	8.44	100.00
	88	34.53	14.33	9.17	8.07	3.13	17.12	2.55	1.20	9.89	100.00
	89	35.10	14.57	10.40	8.88	3.44	16.38	2.72	0.92	7.58	100.00
	90	41.08	11.01	8.28	9.78	3.81	15.83	3.01	0.91	6.27	100.00
	91	44.50	8.11	5.59	9.25	3.63	14.89	2.84	1.29	9.89	100.00
MEAN		39.22	11.66	8.06	9.19	3.67	16.29	2.86	1.02	8.05	100.00
PO4											
	84	6.54	10.57	7.98	1.37	2.51	25.92	2.53	1.87	40.71	100.00
	85	4.76	7.41	5.24	1.23	1.06	15.87	2.34	2.56	59.50	100.00
	86	4.20	8.94	5.32	1.06	0.81	14.42	2.07	1.82	61.37	100.00
	87	4.08	8.25	6.21	1.00	0.83	26.55	1.92	2.16	49.01	100.00
	88	3.34	12.19	9.22	0.91	0.74	13.25	1.75	2.24	56.37	100.00
	89	5.60	14.73	12.56	1.37	1.03	20.06	2.40	2.26	39.99	100.00
	90	6.49	12.69	9.84	1.67	1.28	26.75	2.88	2.43	35.95	100.00
	91	5.82	7.59	4.77	1.61	1.05	15.57	2.75	3.47	57.34	100.00
MEAN		5.09	10.39	7.70	1.26	1.20	20.17	2.31	2.27	49.61	100.00
ORGP											
	84	32.87	14.38	6.74	10.43	5.49	8.17	11.79	1.79	8.36	100.00
	85	17.56	8.23	3.66	7.43	4.23	4.32	23.24	5.26	26.07	100.00
	86	20.24	11.28	5.67	6.99	2.84	5.78	18.93	3.44	24.81	100.00
	87	27.57	8.24	3.97	8.19	3.25	4.44	18.83	4.34	21.18	100.00
	88	15.65	7.40	2.74	7.97	3.63	4.08	21.74	5.81	30.96	100.00
	89	24.32	10.24	4.65	8.59	3.63	5.43	22.36	4.32	16.47	100.00
	90	25.22	9.22	4.07	9.63	4.20	5.10	24.68	4.26	13.61	100.00
	91	17.09	5.84	2.37	5.08	3.88	2.72	28.91	7.50	26.61	100.00
MEAN		24.82	10.49	4.84	8.58	4.13	5.70	19.27	3.89	18.27	100.00

Segment 60

		<----------Pervious					----------><---Impervious->		Point	Total
		FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Source	Load
TP											
	84	18.22	12.01	7.21	5.41	3.79	17.24	9.29	1.78	25.06	100.00
	85	8.17	7.39	4.63	2.92	1.91	12.15	11.30	3.23	48.30	100.00
	86	8.82	9.38	5.28	2.78	1.38	11.46	9.79	2.25	48.86	100.00
	87	10.60	8.02	5.41	3.00	1.49	19.61	9.30	2.72	39.84	100.00
	88	6.17	10.74	7.45	2.56	1.41	10.74	9.01	3.03	48.91	100.00
	89	10.85	12.95	9.86	3.42	1.75	15.16	11.36	2.79	31.87	100.00
	90	11.98	11.15	7.71	4.04	2.13	19.11	13.22	2.90	27.77	100.00
	91	8.59	6.84	3.95	2.46	1.76	11.57	13.41	4.40	47.01	100.00
MEAN		11.14	10.10	6.57	3.52	2.09	15.02	10.60	2.71	38.26	100.00
BOD											
	84	48.77	12.17	4.07	15.47	8.15	7.70	1.62	0.79	1.26	100.00
	85	39.32	10.39	3.62	16.63	9.47	6.25	4.83	3.53	5.93	100.00
	86	42.79	12.41	4.36	14.79	6.00	6.98	3.71	2.18	6.76	100.00
	87	49.71	10.03	3.28	14.76	5.85	5.79	3.15	2.35	5.09	100.00
	88	36.22	10.74	3.26	18.44	8.40	6.60	4.66	4.03	7.69	100.00
	89	44.48	11.04	4.12	15.71	6.64	7.10	3.79	2.37	4.74	100.00
	90	45.17	10.14	3.46	17.23	7.52	6.30	4.10	2.29	3.84	100.00
	91	39.95	8.97	3.52	11.86	9.08	5.31	6.27	5.25	9.79	100.00
MEAN		45.29	11.19	3.83	15.65	7.54	6.86	3.26	2.13	4.26	100.00
SED											
	84	57.96	13.83	5.44	8.94	3.71	10.12	0.00	0.00	0.00	100.00
	85	43.16	18.42	6.95	13.04	5.08	13.34	0.00	0.00	0.00	100.00
	86	49.13	18.51	7.84	9.39	2.38	12.73	0.00	0.00	0.00	100.00
	87	58.55	13.05	5.32	10.69	2.74	9.67	0.00	0.00	0.00	100.00
	88	41.95	18.14	5.93	15.64	4.63	13.72	0.00	0.00	0.00	100.00
	89	52.42	16.03	6.15	10.85	2.83	11.73	0.00	0.00	0.00	100.00
	90	51.74	15.09	5.73	12.43	3.45	11.58	0.00	0.00	0.00	100.00
	91	41.76	20.20	7.34	11.11	5.48	14.12	0.00	0.00	0.00	100.00
MEAN		53.50	15.37	6.01	10.41	3.50	11.22	0.00	0.00	0.00	100.00

Segment 70

		<--------	--------	Pervious	--------	--------	><---Impervious->		Point	Total
		FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Source	Load
NH3											
	84	6.20	18.30	10.89	1.28	1.10	21.44	2.16	1.12	37.47	100.00
	85	5.00	13.18	7.77	1.04	0.58	16.69	1.98	1.45	52.32	100.00
	86	5.88	26.82	18.54	1.14	0.73	6.14	2.25	1.15	37.35	100.00
	87	5.18	20.71	13.64	1.02	0.60	11.58	1.89	1.30	44.03	100.00
	88	4.46	25.24	16.08	0.86	0.55	9.29	1.80	1.14	40.54	100.00
	89	4.48	33.63	23.96	0.86	0.55	7.53	1.56	0.86	26.55	100.00
	90	5.87	33.30	22.45	1.13	0.71	6.26	2.13	1.04	27.13	100.00
	91	5.71	23.23	17.10	1.11	0.69	4.99	2.18	1.52	43.49	100.00
MEAN		5.35	25.26	16.98	1.05	0.69	10.28	1.99	1.16	37.25	100.00
NO3											
	84	16.36	28.57	21.43	5.83	3.42	18.91	0.10	0.46	4.92	100.00
	85	17.25	23.51	15.54	6.10	3.33	25.25	0.11	0.71	8.20	100.00
	86	20.42	22.75	17.00	6.56	3.63	23.16	0.12	0.55	5.80	100.00
	87	18.12	21.11	14.23	6.26	3.42	29.00	0.11	0.65	7.10	100.00
	88	15.53	26.77	18.09	5.19	2.87	24.27	0.10	0.58	6.59	100.00
	89	14.03	29.41	20.04	5.35	3.01	23.09	0.10	0.46	4.54	100.00
	90	19.02	24.11	19.39	6.44	3.62	22.59	0.12	0.50	4.20	100.00
	91	25.51	15.13	10.10	7.64	4.14	28.50	0.14	0.86	7.97	100.00
MEAN		17.92	24.59	17.64	6.10	3.41	23.80	0.11	0.57	5.87	100.00
ORGN											
	84	13.54	25.56	13.82	4.44	5.01	9.17	13.74	2.79	11.90	100.00
	85	12.97	19.94	11.18	2.92	2.12	3.75	18.05	5.20	23.87	100.00
	86	9.42	23.96	13.15	3.33	3.30	7.06	19.60	3.89	16.28	100.00
	87	11.23	18.22	10.06	2.94	2.82	5.82	20.15	5.39	23.40	100.00
	88	13.57	23.33	12.83	2.72	2.53	7.72	15.70	3.93	17.67	100.00
	89	12.61	24.74	14.76	3.16	2.92	7.83	16.47	3.56	13.97	100.00
	90	11.01	31.89	19.28	2.40	2.28	8.51	13.51	2.56	8.59	100.00
	91	6.69	29.73	11.28	3.23	2.88	4.62	18.32	4.97	18.28	100.00
MEAN		11.52	25.54	14.04	3.16	3.07	7.26	16.34	3.74	15.32	100.00
TN											
	84	14.53	26.66	18.91	5.00	3.29	17.91	2.59	0.85	10.26	100.00
	85	14.72	21.33	13.73	4.90	2.74	21.45	2.81	1.30	17.01	100.00
	86	16.77	23.41	16.73	5.30	3.11	18.53	3.15	1.01	11.98	100.00
	87	15.20	20.68	13.67	5.03	2.87	23.72	2.79	1.20	14.84	100.00
	88	13.40	26.00	17.07	4.17	2.43	19.78	2.62	1.05	13.47	100.00
	89	12.15	29.56	20.12	4.32	2.55	18.73	2.41	0.84	9.33	100.00
	90	15.74	26.55	19.74	5.00	2.96	17.91	2.87	0.88	8.35	100.00
	91	19.38	18.37	11.45	5.86	3.33	21.06	3.43	1.50	15.62	100.00
MEAN		15.05	24.69	17.02	4.91	2.91	19.56	2.80	1.03	12.01	100.00
PO4											
	84	1.13	10.19	7.12	0.39	0.84	24.79	1.23	1.24	53.06	100.00
	85	0.71	7.33	5.72	0.28	0.28	14.35	1.04	1.48	68.81	100.00
	86	1.09	13.42	9.87	0.40	0.51	13.43	1.41	1.40	58.49	100.00
	87	0.86	7.43	5.05	0.34	0.36	17.18	1.14	1.52	66.11	100.00
	88	0.84	12.36	10.31	0.29	0.37	13.40	1.07	1.30	60.07	100.00
	89	1.02	16.93	14.97	0.36	0.45	16.84	1.17	1.26	47.02	100.00
	90	1.28	17.02	14.01	0.44	0.53	20.57	1.44	1.37	43.37	100.00
	91	1.06	9.08	6.39	0.40	0.49	10.46	1.46	1.96	68.72	100.00
MEAN		1.01	12.02	9.45	0.36	0.49	16.82	1.24	1.41	57.19	100.00
ORGP											
	84	8.21	30.06	15.64	2.69	3.04	10.44	9.72	1.69	18.53	100.00
	85	7.53	22.48	12.10	1.69	1.23	4.09	12.22	3.02	35.60	100.00
	86	5.57	27.48	14.52	1.97	1.95	7.88	13.53	2.30	24.78	100.00
	87	6.56	20.66	10.96	1.72	1.65	6.42	13.73	3.15	35.12	100.00
	88	7.98	26.59	14.07	1.60	1.49	8.58	10.77	2.31	26.61	100.00
	89	7.60	28.94	16.62	1.90	1.76	8.96	11.57	2.14	20.49	100.00
	90	6.51	36.65	21.35	1.42	1.35	9.53	9.32	1.52	12.36	100.00
	91	3.91	33.66	12.29	1.89	1.68	5.21	12.48	2.90	25.97	100.00
MEAN		6.83	29.37	15.54	1.87	1.82	8.14	11.29	2.22	22.90	100.00

Segment 70

		FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Point Source	Total Load
		<-----------------------	Pervious				---------------------->	<---Impervious->			
TP											
	84	3.45	16.58	9.82	1.14	1.55	19.65	5.62	1.37	40.80	100.00
	85	2.41	11.01	7.23	0.63	0.51	11.56	5.36	1.85	59.43	100.00
	86	2.36	17.21	11.02	0.85	0.92	11.56	6.83	1.63	47.62	100.00
	87	2.25	10.55	6.42	0.67	0.67	14.26	5.89	1.89	57.41	100.00
	88	2.83	16.17	11.21	0.65	0.68	11.85	5.29	1.56	49.78	100.00
	89	2.87	20.06	15.20	0.79	0.81	14.33	5.74	1.49	38.73	100.00
	90	3.22	24.09	16.52	0.80	0.83	16.06	6.12	1.40	30.95	100.00
	91	1.93	16.57	8.11	0.85	0.85	8.62	6.81	2.22	54.03	100.00
MEAN		2.74	17.03	11.12	0.81	0.88	13.93	5.94	1.63	45.92	100.00
BOD											
	84	25.97	26.16	8.96	8.53	9.61	11.12	2.85	1.61	5.21	100.00
	85	29.95	23.12	8.75	6.73	4.88	5.94	4.51	3.60	12.54	100.00
	86	20.97	28.16	10.24	7.42	7.35	9.79	4.72	2.60	8.77	100.00
	87	24.98	23.62	8.69	6.54	6.28	8.94	4.85	3.59	12.50	100.00
	88	27.59	27.52	9.43	5.53	5.14	10.55	3.45	2.40	8.41	100.00
	89	25.80	27.29	10.47	6.46	5.98	10.19	3.64	2.18	7.96	100.00
	90	23.63	33.59	12.35	5.14	4.89	10.46	3.14	1.65	5.14	100.00
	91	15.68	33.37	9.26	7.58	6.74	7.31	4.65	3.49	11.93	100.00
MEAN		24.43	28.33	10.02	6.71	6.51	9.73	3.75	2.38	8.10	100.00
SED											
	84	14.83	40.81	17.78	5.56	2.98	18.06	0.00	0.00	0.00	100.00
	85	21.34	43.08	19.40	4.47	1.17	10.55	0.00	0.00	0.00	100.00
	86	11.21	45.15	20.19	4.58	1.94	16.95	0.00	0.00	0.00	100.00
	87	16.50	41.95	18.43	4.60	1.75	16.78	0.00	0.00	0.00	100.00
	88	16.59	42.25	18.71	3.64	1.43	17.35	0.00	0.00	0.00	100.00
	89	15.46	42.33	20.16	3.96	1.55	16.57	0.00	0.00	0.00	100.00
	90	10.87	47.16	22.81	2.57	1.02	15.57	0.00	0.00	0.00	100.00
	91	6.90	57.36	17.83	4.64	1.71	11.55	0.00	0.00	0.00	100.00
MEAN		13.64	44.79	19.81	4.10	1.73	15.91	0.00	0.00	0.00	100.00

Per Acre Load Contributed from Each Land Use in West Branch Susquehanna Basin (lb/ac)

Segment 50

	<------Pervious					------><	----Impervious---->		Total
	FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Load
NH3									
84	0.156	4.393	4.463	0.368	0.819	2.607	313.1727	1.06	0.407338
85	0.142	2.989	2.686	0.313	0.488	2.09	273.7041	0.985	0.320939
86	0.144	4.501	4.34	0.313	0.491	1.299	342.381	1.06	0.342147
87	0.128	9.582	12.56	0.281	0.46	2.192	256.3925	1.04	0.493501
88	0.128	4.787	3.798	0.272	0.39	1.236	245.1919	1.04	0.317629
89	0.153	9.207	10.91	0.313	0.444	3.922	280.8457	0.982	0.551973
90	0.183	6.435	7.276	0.394	0.626	1.626	342.5437	1.14	0.451454
91	0.123	2.881	3.406	0.247	0.308	0.6736	223.6858	1.0	0.248895
1992	0.144625	5.596875	6.179875	0.312625	0.50325	1.9557	284.7397	1.038375	0.391734
NO3									
84	2.17	22.59	25.19	8.1	11.7	16.48	78.29317	2.21	4.062413
85	2.32	11.61	12.09	7.83	10.4	16.84	68.42602	2.05	3.820746
86	2.22	12.92	18.21	7.33	9.969999	16.79	85.59524	2.21	3.737557
87	1.76	16.08	20.87	6.74	9.07	16.92	64.09812	2.17	3.356731
88	2.04	17.21	18.71	7.08	9.2	17.1	61.29798	2.16	3.634237
89	2.07	18.28	21.54	7.86	10.4	18.01	70.21142	2.03	3.840882
90	2.79	19.26	24.12	9.53	12.9	18.73	85.63592	2.37	4.733065
91	2.13	8.443	8.763	6.66	8.48	13.51	55.92144	2.09	3.301344
1992	2.1875	15.79913	18.68663	7.64125	10.265	16.7975	71.18492	2.16125	3.810872
ORGN									
84	0.353934	1.822	1.289	1.00541	3.7842	0.5311	1879.036	3.7842	0.718328
85	0.167692	1.005	0.6908	0.5565	1.5953	0.255	1642.225	3.5245	0.391149
86	0.243747	1.691	1.215	0.68635	1.69918	0.4684	2054.286	3.7842	0.512729
87	0.165466	0.8992	0.605	0.55279	1.62127	0.2629	1538.355	3.7471	0.384741
88	0.092379	0.5055	0.3416	0.368403	1.08703	0.1395	1471.152	3.69516	0.269677
89	0.123543	0.6369	0.4491	0.4452	1.23914	0.1635	1685.074	3.54305	0.320914
90	0.236327	1.258	0.824	0.77168	2.14067	0.3696	2055.262	4.081	0.522308
91	0.069377	0.3032	0.1644	0.257103	0.64183	0.0634	1342.115	3.60241	0.2077
1992	0.181558	1.0151	0.697362	0.580429	1.726077	0.281675	1708.438	3.720202	0.415943
TN									
84	2.679934	28.81	30.94	9.473411	16.3032	19.62	2740.261	7.0542	5.210382
85	2.629692	15.61	15.47	8.6995	12.4833	19.19	2394.911	6.5595	4.552485
86	2.607747	19.11	23.76	8.32935	12.16018	18.56	2995.833	7.0542	4.616666
87	2.053466	26.56	34.04	7.57379	11.15127	19.38	2243.434	6.9571	4.253266
88	2.260379	22.51	22.85	7.720403	10.67703	18.48	2145.429	6.89516	4.239178
89	2.346543	28.12	32.9	8.6182	12.08314	22.09	2457.4	6.55505	4.733399
90	3.209327	26.95	32.22	10.69568	15.66667	20.73	2997.257	7.591	5.731131
91	2.322377	11.63	12.33	7.164103	9.42983	14.25	1957.25	6.69241	3.773892
1992	2.513683	22.4125	25.56375	8.534305	12.49433	19.0375	2491.472	6.919827	4.6388
PO4									
84	0.01375	0.9205	1.014	0.0475	0.284	1.678	78.29317	0.487	0.109606
85	0.0111	0.6475	0.5793	0.04319	0.137	1.117	68.42602	0.454	0.075216
86	0.01231	1.113	1.22	0.04269	0.144	0.9496	85.59524	0.487	0.085308
87	0.01017	0.8133	0.8372	0.03778	0.135	1.323	64.09812	0.481	0.084806
88	0.009511	0.7781	0.9113	0.03968	0.102	0.8402	61.29798	0.477	0.068013
89	0.01204	0.9406	1.182	0.04529	0.116	1.891	70.21142	0.455	0.107557
90	0.0151	1.214	1.328	0.05605	0.184	1.286	85.63592	0.527	0.103481
91	0.009745	0.4408	0.4313	0.03885	0.07265	0.4638	55.92144	0.464	0.045855
1992	0.011716	0.858475	0.937888	0.043879	0.146831	1.193575	71.18492	0.479	0.08498
ORGP									
84	0.050562	0.5055	0.3438	0.14363	0.5406	0.1424	313.1727	0.5406	0.112529
85	0.023956	0.2783	0.1839	0.0795	0.2279	0.06851	273.7041	0.5035	0.061862
86	0.034821	0.4686	0.3239	0.09805	0.24274	0.1261	342.381	0.5406	0.082717
87	0.023638	0.2496	0.1615	0.07897	0.23161	0.07086	256.3925	0.5353	0.060538
88	0.013197	0.1402	0.09114	0.052629	0.15529	0.03772	245.1919	0.52788	0.042311
89	0.017649	0.1766	0.1197	0.0636	0.17702	0.0438	280.8457	0.50615	0.050376
90	0.033761	0.3496	0.2207	0.11024	0.30581	0.09945	342.5437	0.583	0.082305
91	0.009911	0.08413	0.04381	0.036729	0.09169	0.01699	223.6858	0.51463	0.032351
1992	0.025937	0.281566	0.186056	0.082918	0.246582	0.075729	284.7397	0.531457	0.065624

Segment 50

	FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Total Load
	<-----	-----	Pervious	-----	-----	---->	<----Impervious	---->	
TP									
84	0.064312	1.426	1.357	0.19113	0.8246	1.82	548.0522	1.0276	0.229504
85	0.035056	0.9258	0.7633	0.12269	0.3649	1.186	478.9821	0.9575	0.143548
86	0.047131	1.581	1.544	0.14074	0.38674	1.076	599.1667	1.0276	0.176096
87	0.033808	1.063	0.9987	0.11675	0.36661	1.394	448.6868	1.0163	0.151396
88	0.022708	0.9182	1.002	0.092309	0.25729	0.878	429.0859	1.00488	0.116104
89	0.029689	1.117	1.301	0.10889	0.29302	1.935	491.4799	0.96115	0.164555
90	0.048861	1.564	1.548	0.16629	0.48981	1.386	599.4514	1.11	0.193885
91	0.019656	0.5249	0.4751	0.075579	0.16434	0.4808	391.4501	0.97863	0.08348
MEAN	0.037653	1.139987	1.123637	0.126797	0.393414	1.269475	498.2944	1.010457	0.157321
BOD									
84	9.54	58.2	27.57	27.1	102.0	17.52	5480.522	30.6	16.89773
85	4.52	27.87	14.79	15.0	43.0	8.01	4789.821	28.5	8.173622
86	6.57	44.4	22.8	18.5	45.8	13.44	5991.667	30.6	10.86275
87	4.46	33.0	15.72	14.9	43.7	10.05	4486.868	30.3	8.31835
88	2.49	17.52	9.900001	9.929999	29.3	5.67	4290.859	29.88	5.177204
89	3.33	22.86	13.56	12.0	33.4	7.32	4914.799	28.65	6.409463
90	6.37	42.6	20.85	20.8	57.7	12.9	5994.514	33.0	11.38318
91	1.87	12.21	7.710001	6.93	17.3	3.81	3914.501	29.13	3.689134
MEAN	4.89375	32.3325	16.6125	15.645	46.525	9.84	4982.944	30.0825	8.86393
SED									
84	0.0845	0.562	0.323	0.169	0.331	0.212	0.0	0.0	0.116701
85	0.03833	0.31	0.174	0.0864	0.117	0.108	0.0	0.0	0.053895
86	0.06327	0.517	0.305	0.111	0.129	0.185	0.0	0.0	0.083833
87	0.03042	0.28	0.156	0.08769	0.125	0.11	0.0	0.0	0.047332
88	0.01439	0.166	0.09098	0.0523	0.07	0.06538	0.0	0.0	0.024959
89	0.02121	0.216	0.125	0.06406	0.07983	0.08007	0.0	0.0	0.033528
90	0.044	0.394	0.213	0.122	0.161	0.152	0.0	0.0	0.066668
91	0.006788	0.106	0.05584	0.03199	0.02731	0.03998	0.0	0.0	0.01304
MEAN	0.037863	0.318875	0.180353	0.090555	0.130018	0.119054	0.0	0.0	0.054995

Segment 60

	<-----	-----	-----Pervious-----	-----	-----	----->	<----Impervious---->		Total
	FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Load
NH3									
84	0.169	6.034	6.177	0.423	0.936	2.097	319.6273	1.25	0.533528
85	0.108	2.844	3.0	0.237	0.363	1.289	201.2485	1.18	0.298197
86	0.132	3.716	3.22	0.294	0.416	0.8043	264.0674	1.24	0.327376
87	0.109	3.476	3.601	0.248	0.359	1.44	207.7573	1.24	0.330697
88	0.09003	3.601	3.196	0.204	0.299	0.7594	173.1431	1.2	0.274339
89	0.131	5.903	6.783	0.283	0.399	1.254	227.356	1.14	0.446773
90	0.168	4.735	5.441	0.374	0.536	1.311	303.6626	1.36	0.446966
91	0.1	2.575	2.652	0.216	0.303	0.5172	181.9571	1.22	0.241486
1992	0.125879	4.1105	4.25875	0.284875	0.451375	1.183987	234.8524	1.22875	0.36242
NO3									
84	2.3	26.38	28.56	9.01	13.3	16.71	79.90681	3.17	4.432473
85	1.79	10.98	10.91	6.15	8.28	13.18	50.31212	2.98	2.996803
86	2.09	16.62	17.69	7.32	9.85	15.2	66.01686	3.14	3.659616
87	1.54	19.06	20.01	6.08	8.18	16.66	51.93932	3.13	3.262924
88	1.43	20.27	20.02	5.21	6.95	13.44	43.28578	3.03	2.984159
89	1.72	23.66	25.33	7.03	9.469999	15.38	56.839	2.88	3.607898
90	2.47	22.05	25.36	9.33	12.6	18.11	75.91566	3.44	4.501629
91	1.77	10.12	10.65	5.95	7.84	11.17	45.48928	3.09	2.8471
1992	1.88875	18.6425	19.81625	7.01	9.55875	14.98125	58.7131	3.1075	3.536575
ORGN									
84	0.4823	4.04	2.959	2.45973	4.5633	1.169	1917.764	3.69887	0.940571
85	0.082362	0.7393	0.5149	0.56021	1.12413	0.1969	1207.491	3.48369	0.248632
86	0.152852	1.632	1.284	0.84959	1.21317	0.4248	1584.405	3.66919	0.392563
87	0.164724	0.9415	0.7087	0.78652	1.09816	0.2575	1246.544	3.65806	0.34341
88	0.067522	0.6128	0.354	0.55279	0.88669	0.171	1038.859	3.53563	0.21503
89	0.133931	1.079	0.7653	0.76055	1.13155	0.2899	1364.136	3.35755	0.327932
90	0.168063	1.174	0.8091	1.03138	1.58417	0.3275	1821.976	4.0068	0.415902
91	0.058247	0.3809	0.242	0.27825	0.74942	0.09019	1091.743	3.60612	0.183973
1992	0.16375	1.324937	0.954625	0.909877	1.543824	0.365849	1409.115	3.626989	0.383502
TN									
84	2.9513	36.45	37.7	11.89273	18.7993	19.97	2796.739	8.11887	5.937519
85	1.980362	14.56	14.43	6.94721	9.76713	14.67	1760.924	7.64369	3.563503
86	2.374852	21.97	22.2	8.46359	11.47917	16.43	2310.59	8.04919	4.405554
87	1.813724	23.48	24.32	7.11452	9.63716	18.36	1817.876	8.02806	3.957523
88	1.587552	24.48	23.57	5.96679	8.135691	14.38	1515.002	7.76563	3.490815
89	1.984931	30.64	32.88	8.07355	11.00055	16.92	1989.365	7.37755	4.404635
90	2.806063	27.96	31.61	10.73538	14.72017	19.75	2657.048	8.8068	5.394281
91	1.928247	13.07	13.54	6.44425	8.89242	11.78	1592.125	7.91612	3.290278
1992	2.178379	24.07625	25.03125	8.204752	11.55395	16.5325	2054.959	7.963239	4.305514
PO4									
84	0.01595	0.9578	1.087	0.05377	0.347	1.154	79.90681	0.642	0.121818
85	0.007922	0.458	0.4868	0.03292	0.09992	0.4819	50.31212	0.602	0.056721
86	0.01039	0.8218	0.7347	0.04194	0.113	0.6509	66.01686	0.637	0.080485
87	0.008528	0.6409	0.7258	0.03345	0.09852	1.014	51.93932	0.637	0.089855
88	0.006398	0.8693	0.9884	0.02806	0.08061	0.4641	43.28578	0.606	0.070528
89	0.01028	1.005	1.288	0.04038	0.107	0.6723	56.839	0.586	0.092803
90	0.01325	0.9625	1.122	0.05485	0.148	0.9972	75.91566	0.701	0.110129
91	0.00745	0.3612	0.3414	0.03303	0.07596	0.364	45.48928	0.627	0.045981
1992	0.010021	0.759562	0.846763	0.0398	0.133751	0.7248	58.7131	0.62975	0.08354
ORGP									
84	0.0689	1.121	0.7899	0.35139	0.6519	0.3127	319.6273	0.52841	0.161933
85	0.011766	0.2048	0.1372	0.08003	0.16059	0.05284	201.2485	0.49767	0.041742
86	0.021836	0.4525	0.3422	0.12137	0.17331	0.1139	264.0674	0.52417	0.068362
87	0.023532	0.2614	0.1893	0.11236	0.15688	0.06926	207.7573	0.52258	0.056697
88	0.009646	0.1695	0.09429	0.07897	0.12667	0.04597	173.1431	0.50509	0.035842
89	0.019133	0.2995	0.2046	0.10865	0.16165	0.07806	227.356	0.47965	0.055388
90	0.024009	0.3262	0.2167	0.14734	0.22631	0.08863	303.6626	0.5724	0.069291
91	0.008321	0.1057	0.06459	0.03975	0.10706	0.0242	181.9571	0.51516	0.030114
1992	0.023393	0.367575	0.254847	0.129983	0.220546	0.098195	234.8524	0.518141	0.064921

Segment 60

	<------------------	---------------Pervious	-------------------	-----------------	--------------->	<----Impervious	---->		Total
	FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Load
TP									
84	0.08485	2.079	1.877	0.40516	0.9989	1.467	559.3477	1.17041	0.294189
85	0.019688	0.6627	0.6239	0.11295	0.26051	0.5348	352.1848	1.09967	0.105022
86	0.032226	1.274	1.077	0.16331	0.28631	0.7647	462.118	1.16117	0.157444
87	0.03206	0.9022	0.9151	0.14581	0.2554	1.083	363.5752	1.15958	0.15331
88	0.016044	1.039	1.083	0.10703	0.20728	0.5101	303.0005	1.11109	0.112024
89	0.029413	1.305	1.493	0.14903	0.26865	0.7503	397.873	1.06565	0.155616
90	0.037259	1.289	1.339	0.20219	0.37431	1.086	531.4096	1.2734	0.189337
91	0.015771	0.4669	0.406	0.07278	0.18302	0.3882	318.425	1.14216	0.082026
1992	0.033414	1.127225	1.10175	0.169783	0.354298	0.823012	410.9917	1.147891	0.156121
BOD									
84	13.0	120.6	60.6	66.3	123.0	37.5	5593.477	29.91	22.18335
85	2.22	21.81	11.43	15.1	30.3	6.45	3521.848	28.17	4.475601
86	4.12	44.4	23.46	22.9	32.7	12.27	4621.18	29.67	7.564132
87	4.44	33.3	16.35	21.2	29.6	9.450001	3635.752	29.58	7.144822
88	1.82	20.07	9.150001	14.9	23.9	6.06	3030.005	28.59	3.911372
89	3.61	33.3	18.69	20.5	30.5	10.53	3978.73	27.15	6.514995
90	4.53	37.8	19.41	27.8	42.7	11.55	5314.096	32.4	8.132909
91	1.57	13.11	7.74	7.5	20.2	3.81	3184.25	29.16	2.988314
1992	4.41375	40.54875	20.85375	24.525	41.6125	12.2025	4109.917	29.32875	7.864437
SED									
84	0.142	1.26	0.745	0.352	0.515	0.453	0.0	0.0	0.20649
85	0.015	0.238	0.135	0.07287	0.1	0.0847	0.0	0.0	0.029289
86	0.03678	0.515	0.328	0.113	0.101	0.174	0.0	0.0	0.063073
87	0.03646	0.302	0.185	0.107	0.09673	0.11	0.0	0.0	0.052487
88	0.01226	0.197	0.09677	0.07347	0.07659	0.0732	0.0	0.0	0.024626
89	0.03033	0.345	0.199	0.101	0.09273	0.124	0.0	0.0	0.048779
90	0.03523	0.382	0.218	0.136	0.133	0.144	0.0	0.0	0.057391
91	0.007118	0.128	0.06996	0.03046	0.05294	0.04398	0.0	0.0	0.014369
1992	0.039397	0.420875	0.247091	0.123225	0.145999	0.15086	0.0	0.0	0.062063

Segment 70

	<--------	--------	Pervious	--------	--------	-------->	<----Impervious---->		Total
	FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Load
NH3									
84	0.152	2.672	2.247	0.367	0.771	3.122	283.1689	1.56	0.962024
85	0.08754	1.374	1.145	0.213	0.29	1.736	184.868	1.44	0.524268
86	0.144	3.91	3.82	0.326	0.511	0.8931	293.6644	1.59	0.962871
87	0.108	2.569	2.391	0.248	0.359	1.432	210.5506	1.53	0.731313
88	0.102	3.438	3.095	0.23	0.362	1.262	219.7081	1.48	0.853334
89	0.131	5.855	5.894001	0.294	0.456	1.306	244.0348	1.43	1.34761
90	0.168	5.673	5.405	0.378	0.582	1.063	325.7292	1.68	1.309123
91	0.102	2.468	2.568	0.231	0.35	0.529	207.6036	1.53	0.633173
MEAN	0.124317	3.494875	3.320625	0.285875	0.460125	1.417887	246.166	1.53	0.915464
NO3									
84	2.14	22.25	23.58	8.92	12.8	14.68	70.79224	3.38	7.804791
85	1.35	10.95	10.23	5.58	7.45	11.73	46.217	3.13	4.507773
86	2.26	14.99	15.83	8.5	11.5	15.21	73.41611	3.43	6.542383
87	1.64	11.37	10.83	6.63	8.860001	15.57	52.63766	3.31	5.274784
88	1.53	15.69	14.99	5.98	8.08	14.19	54.92704	3.22	5.772937
89	1.68	20.96	20.19	7.49	10.3	16.41	61.0087	3.09	7.174272
90	2.46	18.55	21.09	9.74	13.4	17.32	81.43231	3.63	7.770036
91	1.74	6.142	5.794	6.1	8.07	11.54	51.90089	3.31	3.938724
MEAN	1.85	15.11275	15.31675	7.3675	10.0575	14.58125	61.54149	3.3125	6.098213
ORGN									
84	0.313866	3.527	2.696	1.20575	3.32045	1.261	1699.014	3.66177	1.281311
85	0.149513	1.368	1.084	0.39326	0.69748	0.2564	1109.208	3.39094	0.550559
86	0.158788	2.404	1.865	0.65667	1.59159	0.7061	1761.987	3.71	0.885516
87	0.132076	1.275	0.995	0.40439	0.94976	0.406	1263.304	3.58386	0.565397
88	0.213696	2.187	1.7	0.50085	1.13897	0.7219	1318.249	3.50595	0.813681
89	0.210357	2.456	2.071	0.61586	1.39496	0.7747	1464.209	3.35755	0.900521
90	0.298655	5.148	4.399	0.76055	1.76596	1.37	1954.376	3.9326	1.556311
91	0.08533	2.256	1.21	0.4823	1.04993	0.3499	1245.622	3.58386	0.653895
MEAN	0.195285	2.577625	2.0025	0.627454	1.488637	0.73075	1476.996	3.590816	0.900899
TN									
84	2.605866	28.45	28.52	10.49275	16.89145	19.06	2477.728	8.601769	10.09768
85	1.587053	13.69	12.45	6.18626	8.43748	13.73	1617.595	7.96094	5.615155
86	2.562788	21.3	21.52	9.48267	13.60259	16.81	2569.564	8.73	8.442646
87	1.880076	15.22	14.22	7.28239	10.16876	17.41	1842.318	8.42386	6.609804
88	1.845696	21.31	19.78	6.71085	9.58097	16.17	1922.446	8.20595	7.477424
89	2.021357	29.27	28.16	8.39986	12.15096	18.49	2135.304	7.87755	9.465674
90	2.926655	29.38	30.89	10.87855	15.74796	19.76	2850.131	9.242599	10.69436
91	1.92733	10.87	9.572	6.8133	9.46993	12.42	1816.531	8.42386	5.262978
MEAN	2.169603	21.18625	20.639	8.280829	12.00626	16.73125	2153.952	8.433315	7.958215
PO4									
84	0.01226	0.6557	0.6477	0.04888	0.261	1.591	70.79224	0.758	0.318445
85	0.005878	0.3627	0.4002	0.02725	0.06652	0.7082	46.217	0.698	0.162763
86	0.0106	0.7798	0.8109	0.04616	0.142	0.7782	73.41611	0.771	0.25442
87	0.007488	0.3829	0.3681	0.03421	0.08943	0.8828	52.63766	0.744	0.18411
88	0.008067	0.7067	0.8329	0.03204	0.101	0.7641	54.92704	0.705	0.240709
89	0.009985	0.9842	1.23	0.04069	0.125	0.9761	61.0087	0.694	0.324792
90	0.01352	1.073	1.248	0.05422	0.16	1.293	81.43231	0.822	0.376538
91	0.007084	0.3611	0.3595	0.031	0.09348	0.4152	51.90089	0.742	0.131285
MEAN	0.00936	0.663262	0.737162	0.039306	0.129804	0.926075	61.54149	0.74175	0.249133
ORGP									
84	0.044838	0.9773	0.7187	0.17225	0.47435	0.3386	283.1689	0.52311	0.279357
85	0.021359	0.3794	0.2888	0.05618	0.09964	0.06889	184.868	0.48442	0.114558
86	0.022684	0.6656	0.4969	0.09381	0.22737	0.1903	293.6644	0.53	0.192054
87	0.018868	0.3536	0.2652	0.05777	0.13568	0.1096	210.5506	0.51198	0.117023
88	0.030528	0.6057	0.4529	0.07155	0.16271	0.195	219.7081	0.50085	0.176236
89	0.030051	0.6813	0.5531	0.08798	0.19928	0.2104	244.0348	0.47965	0.197321
90	0.042665	1.43	1.177	0.10865	0.25228	0.3709	325.7292	0.5618	0.36048
91	0.01219	0.625	0.3226	0.0689	0.14999	0.09646	207.6036	0.51198	0.144903
MEAN	0.027898	0.714737	0.5344	0.089636	0.212662	0.197519	246.166	0.512974	0.197742

Segment 70

	<----------Pervious					----------><----Impervious---->		Total
	FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Load
TP									
84	0.057098	1.633	1.366	0.22113	0.73535	1.929	495.5457	1.28111	0.614371
85	0.027237	0.742	0.689	0.08343	0.16616	0.7771	323.519	1.18242	0.28819
86	0.033284	1.445	1.308	0.13997	0.36937	0.9684	513.9128	1.301	0.463716
87	0.026356	0.7365	0.6333	0.09198	0.22511	0.9924	368.4636	1.25598	0.313523
88	0.038595	1.312	1.286	0.10359	0.26371	0.9591	384.4893	1.20585	0.429846
89	0.040036	1.665	1.783	0.12867	0.32428	1.186	427.0609	1.17365	0.53636
90	0.056185	2.503	2.425	0.16287	0.41228	1.664	570.0262	1.3838	0.756195
91	0.019274	0.9862	0.6821	0.0999	0.24347	0.5117	363.3063	1.25398	0.288419
MEAN	0.037258	1.377838	1.27155	0.128942	0.342466	1.123462	430.7904	1.254724	0.461327
BOD									
84	8.46	50.7	24.54	32.5	89.5	21.48	4955.457	29.61	19.37352
85	4.03	18.51	9.900001	10.6	18.8	4.74	3235.19	27.42	7.385696
86	4.28	34.2	17.58	17.7	42.9	11.85	5139.127	30.0	11.68361
87	3.56	20.04	10.41	10.9	25.6	7.56	3684.636	28.98	7.823766
88	5.76	34.2	16.56	13.5	30.7	13.08	3844.893	28.35	12.00268
89	5.67	35.7	19.35	16.6	37.6	13.29	4270.609	27.15	12.68912
90	8.05	68.10001	35.4	20.5	47.6	21.15	5700.262	31.8	20.27514
91	2.3	29.13	11.43	13.0	28.3	6.360001	3633.063	28.98	8.106542
MEAN	5.26375	36.3225	18.14625	16.9125	40.125	12.43875	4307.904	29.03625	12.41751
SED									
84	0.06655	1.09	0.671	0.292	0.383	0.481	0.0	0.0	0.281652
85	0.03544	0.426	0.271	0.08692	0.05537	0.104	0.0	0.0	0.104239
86	0.03074	0.737	0.466	0.147	0.152	0.276	0.0	0.0	0.172154
87	0.02651	0.401	0.249	0.08636	0.08047	0.16	0.0	0.0	0.100801
88	0.04449	0.674	0.422	0.114	0.11	0.276	0.0	0.0	0.168165
89	0.0464	0.756	0.509	0.139	0.133	0.295	0.0	0.0	0.188353
90	0.0612	1.58	1.08	0.169	0.165	0.52	0.0	0.0	0.35321
91	0.01399	0.692	0.304	0.11	0.09928	0.139	0.0	0.0	0.127188
MEAN	0.040665	0.7945	0.4965	0.143035	0.147265	0.281375	0.0	0.0	0.18697

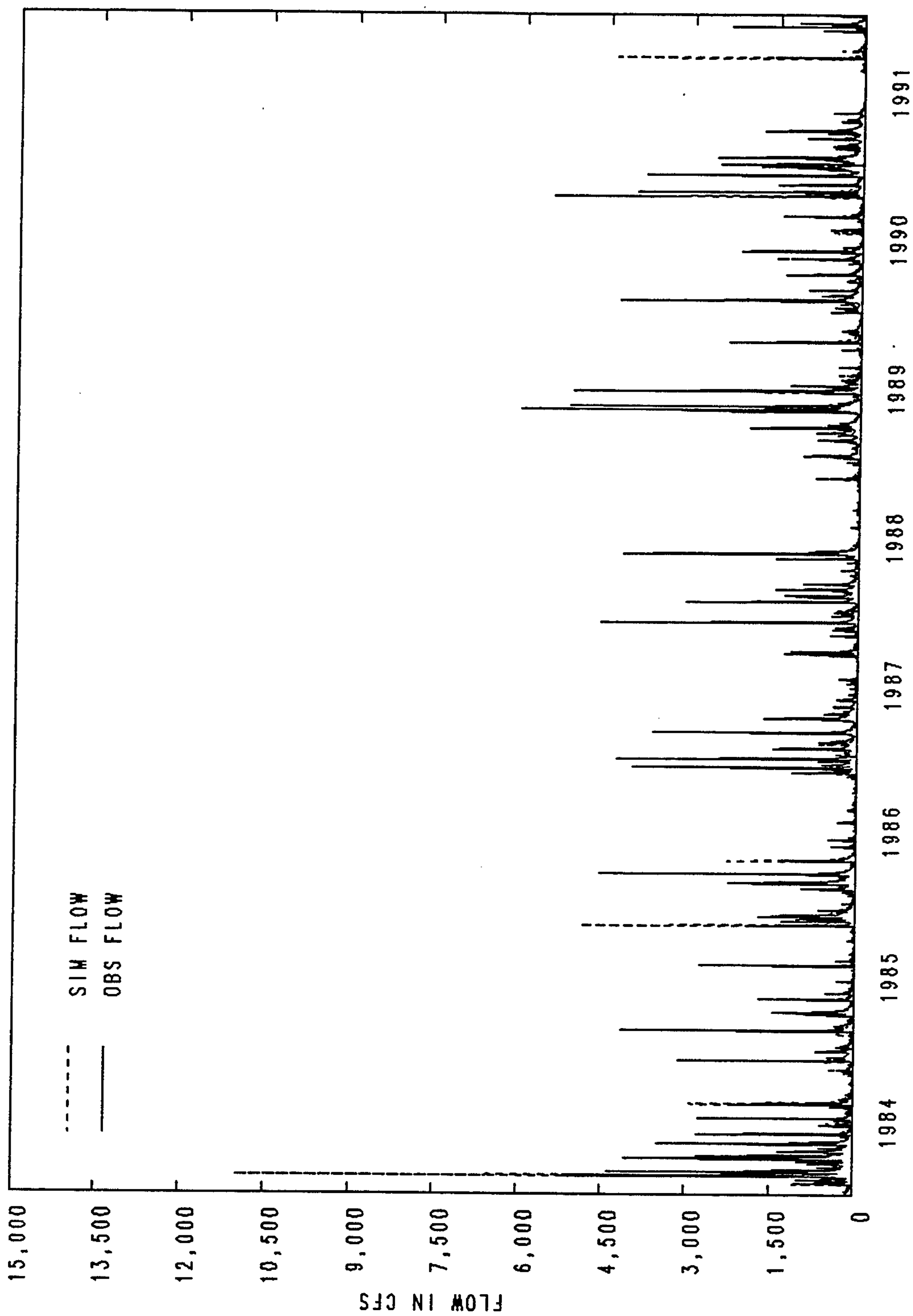
Appendix C
Monocacy Model Segments Results

Simulated and Observed Flow at Reach 750
Frequency Analysis of Flow at Reach 750
Comparison of Annual Total Observed and Simulated Flow Volume
Simulated and Observed Sediment Concentration at Reach 750
Simulated and Observed Water Temperature at Reach 750
Simulated and Observed DO at Reach 750
Simulated and Observed Nitrate-N Concentration at Reach 750
Simulated and Observed Ammonia-N Concentration at Reach 750
Simulated and Observed Organic-N Concentration at Reach 750
Simulated and Observed Total-N Concentration at Reach 750
Simulated and Observed PO_4-P Concentration at Reach 750
Simulated and Observed Organic-P Concentration at Reach 750
Simulated and Observed Total-P Concentration at Reach 750
Simulated and Observed TOC Concentration at Reach 750
Simulated Chlorophyll A Concentration at Reach 750
Simulated BOD Concentration at Reach 750
Simulated Benthic Algae Concentration at Reach 750
AGCHEM Summary for Monocacy Basin (Hi-Till), PERLND 752
AGCHEM Summary for Monocacy Basin (Low-Till), PERLND 753
AGCHEM Summary for Monocacy Basin (HAY), PERLND 756

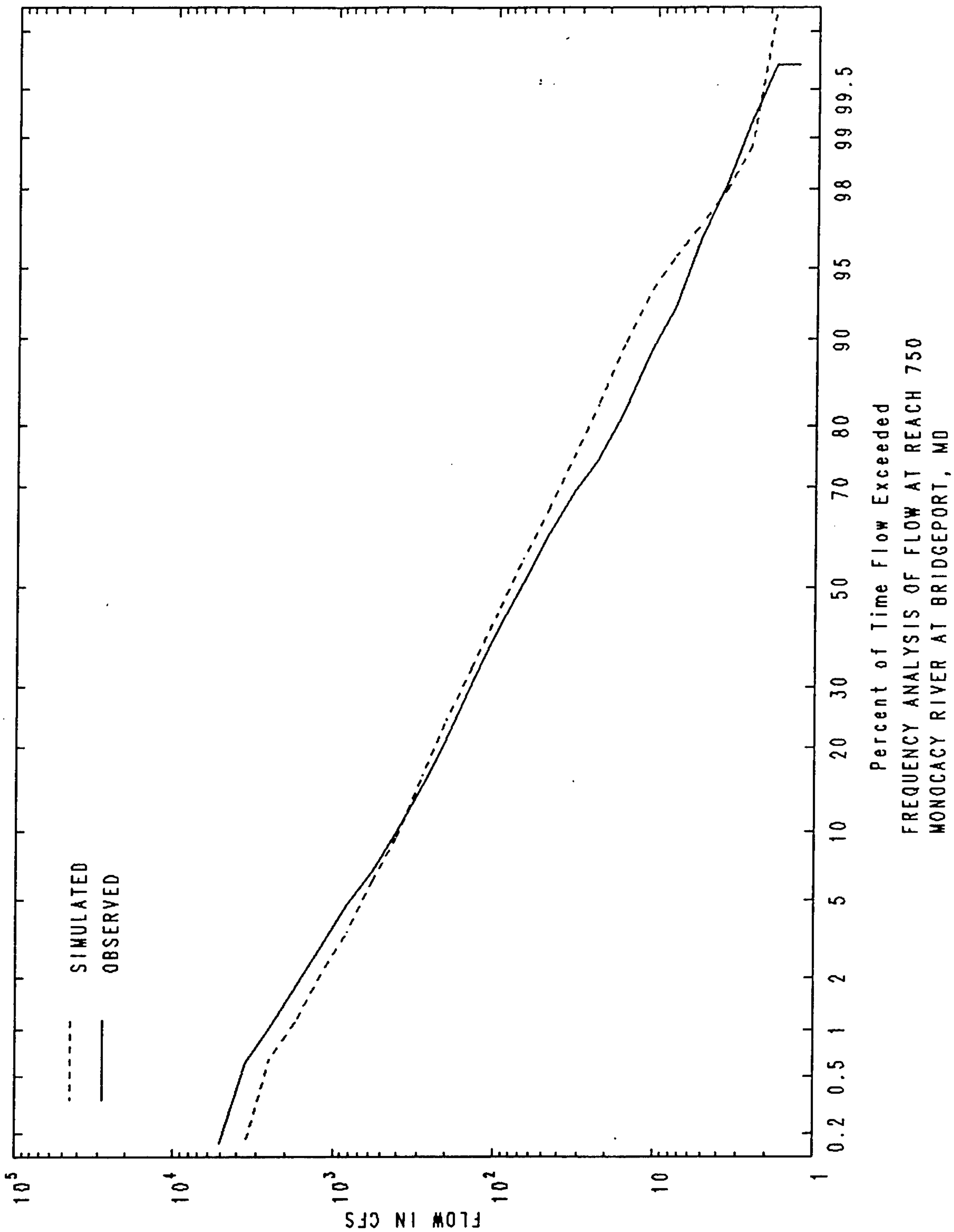
Simulated and Observed Flow at Reach 210
Frequency Analysis of Flow at Reach 210
Comparison of Annual Total Observed and Simulated Flow Volume
Simulated Sediment Concentration at Reach 210
Simulated Water Temperature at Reach 210
Simulated DO at Reach 210
Simulated Nitrate-N Concentration at Reach 210
Simulated Ammonia-N Concentration at Reach 210
Simulated Organic-N Concentration at Reach 210
Simulated Total-N Concentration at Reach 210
Simulated PO_4-P Concentration at Reach 210
Simulated Organic-P Concentration at Reach 210
Simulated Total-P Concentration at Reach 210

Simulated TOC Concentration at Reach 210
Simulated Chlorophyll A Concentration at Reach 210
Simulated BOD Concentration at Reach 210
Simulated Benthic Algae Concentration at Reach 210
AGCHEM Summary for Monocacy Basin (Hi-Till), PERLND 212
AGCHEM Summary for Monocacy Basin (Low-Till), PERLND 213
AGCHEM Summary for Monocacy Basin (HAY), PERLND 216

Per Acre Load Contributed from Each Land Use in Monocacy Basin (lb/ac)
Percent of Total Load Contributed from Each Land Use in Monocacy Basin



SIMULATED AND OBSERVED FLOW AT REACH 750
MONOCACY RIVER AT BRIDGEPORT, MD


SIMULATED
OBSERVED
FLOW IN CFS
10^5
10^4
10^3
10^2
10
1
0.2
0.5
1
2
5
10
20
30
50
70
80
90
95
98
99
99.5
Percent of Time Flow Exceeded
FREQUENCY ANALYSIS OF FLOW AT REACH 750
MONOCACY RIVER AT BRIDGEPORT, MD

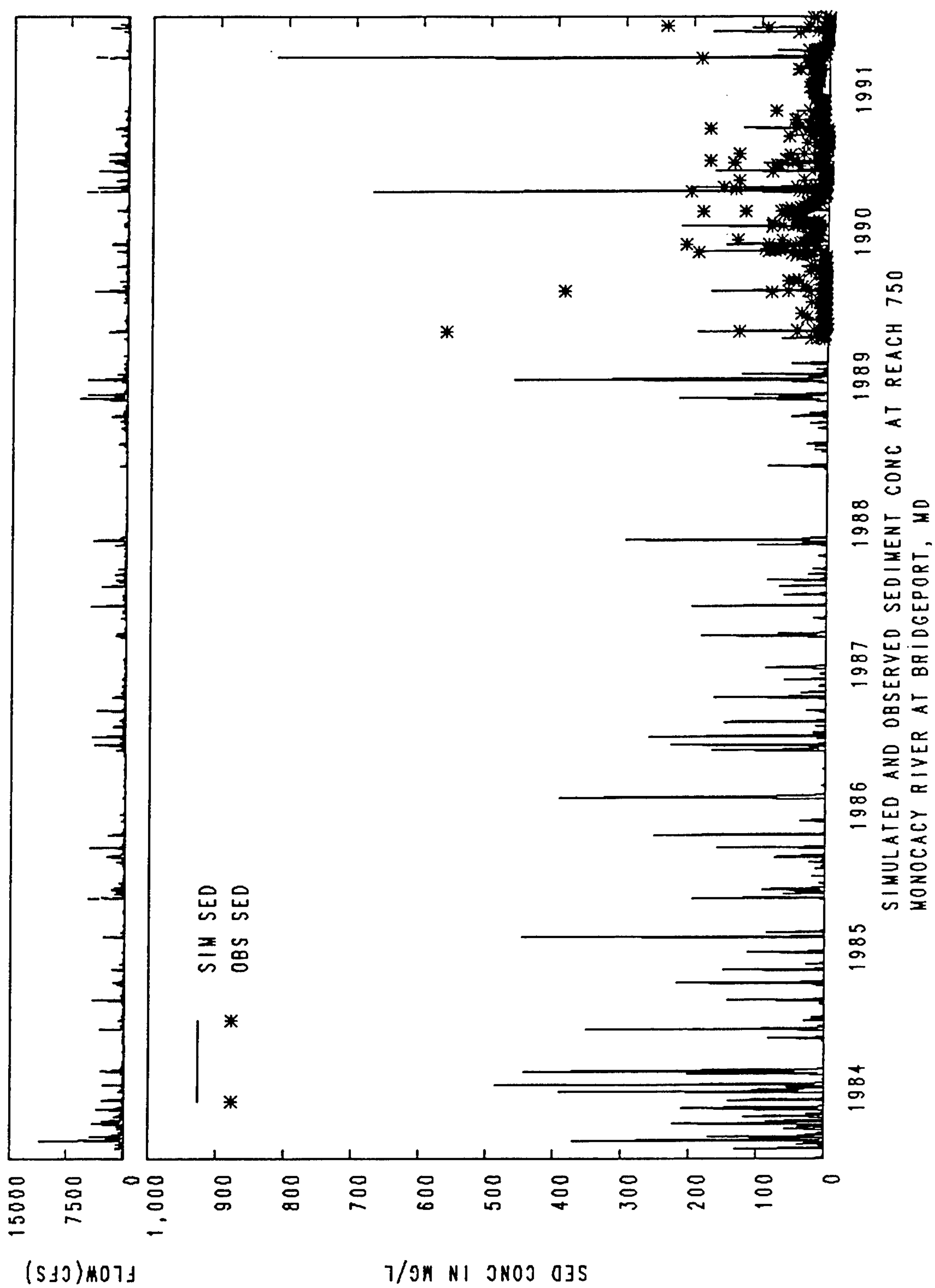
CHESAPEAKE BAY WATERSHED HYDROLOGIC CALIBRATION
COMPARISON OF ANNUAL TOTAL OBSERVED vs SIMULATED FLOW

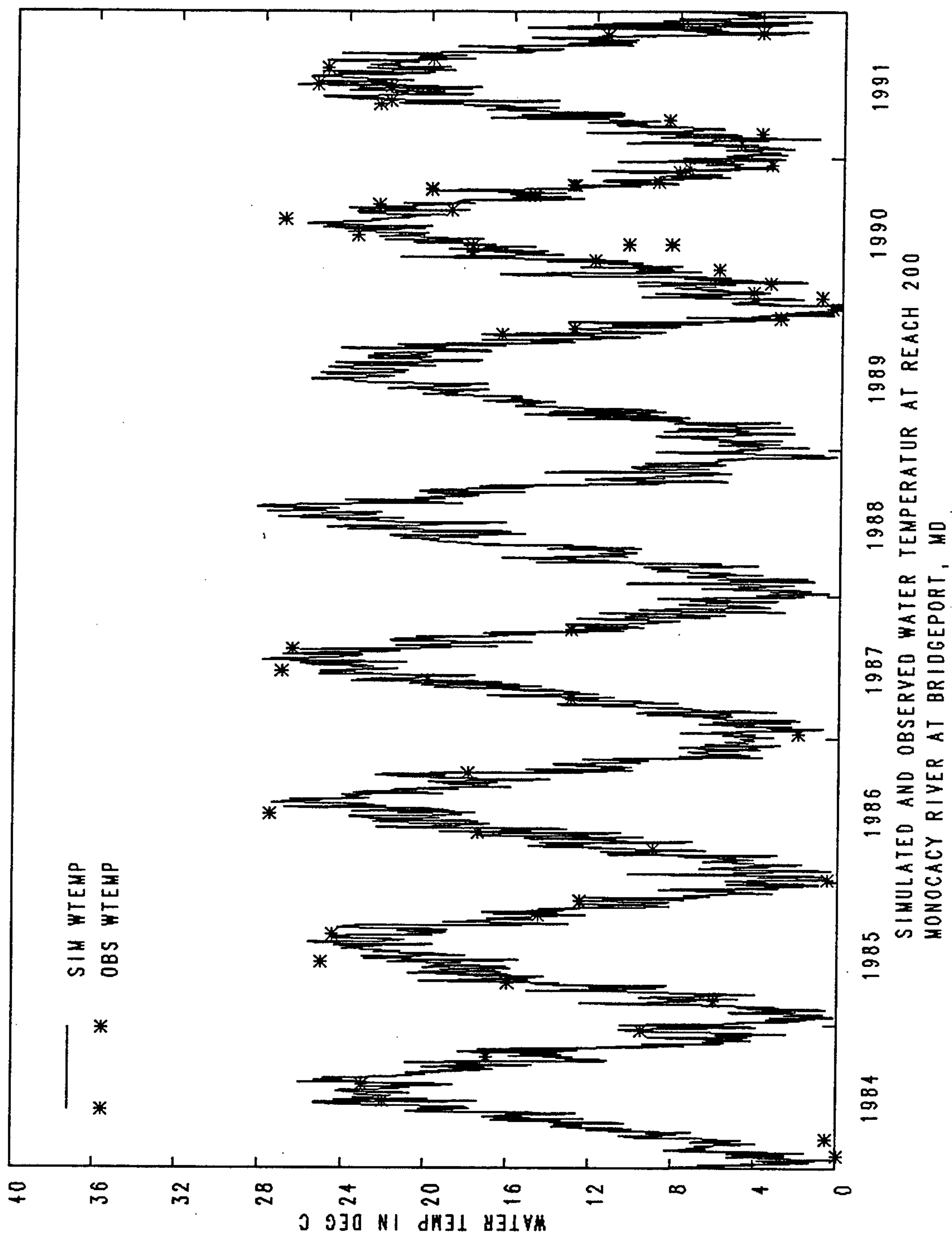
PHASE III

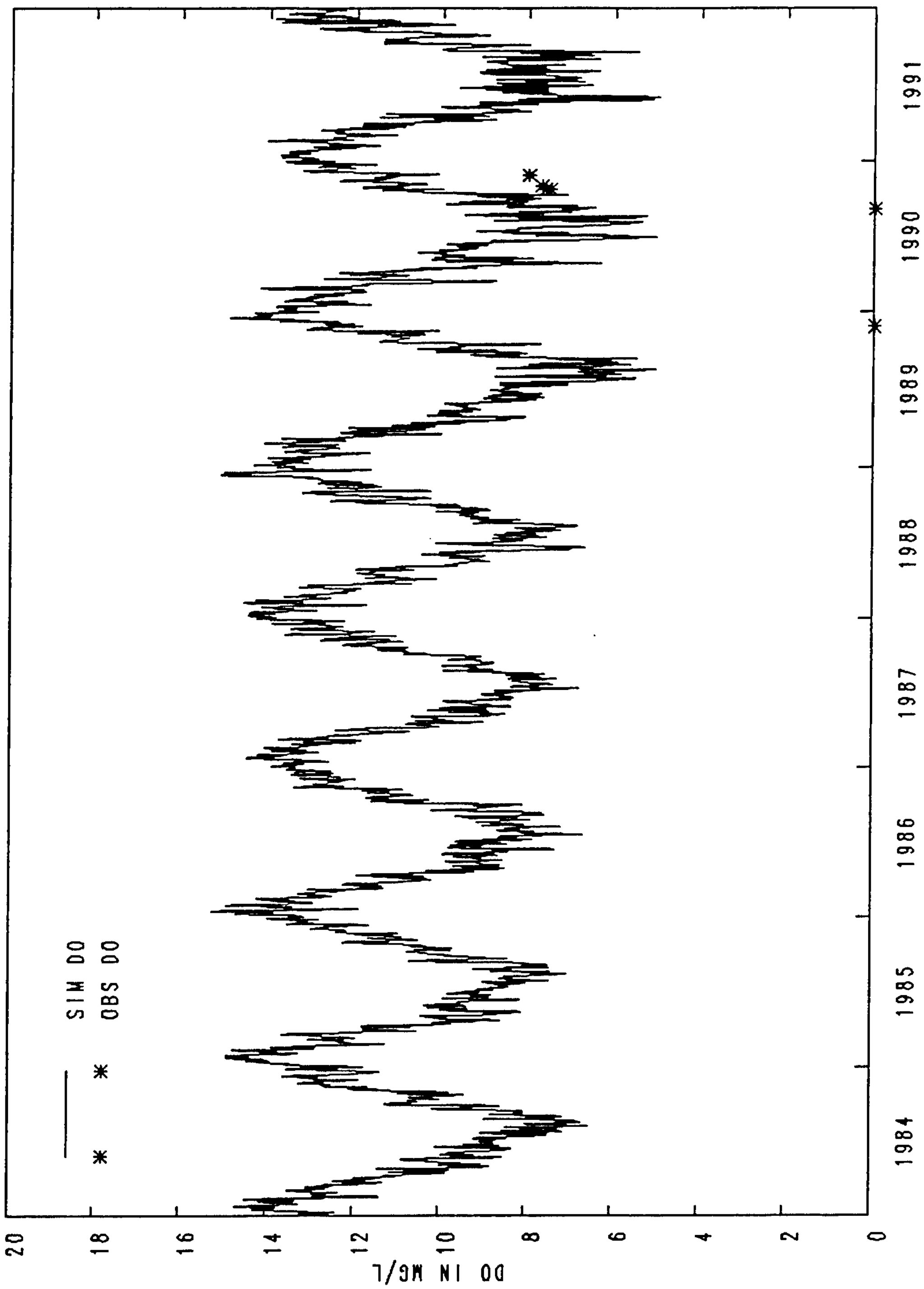
MONOCACY RIVER AT BRIDGEPORT, MD (SEGMENT 750)

YEAR	OBSERVED* FLOW (in)	SIMULATED** FLOW (in)
1984	25.98	26.79
1985	13.27	16.19
1986	14.13	14.41
1987	15.63	10.55
1988	10.85	9.43
1989	18.59	17.26
1990	18.81	17.42
1991	11.84	11.03
MEAN	16.14	15.39

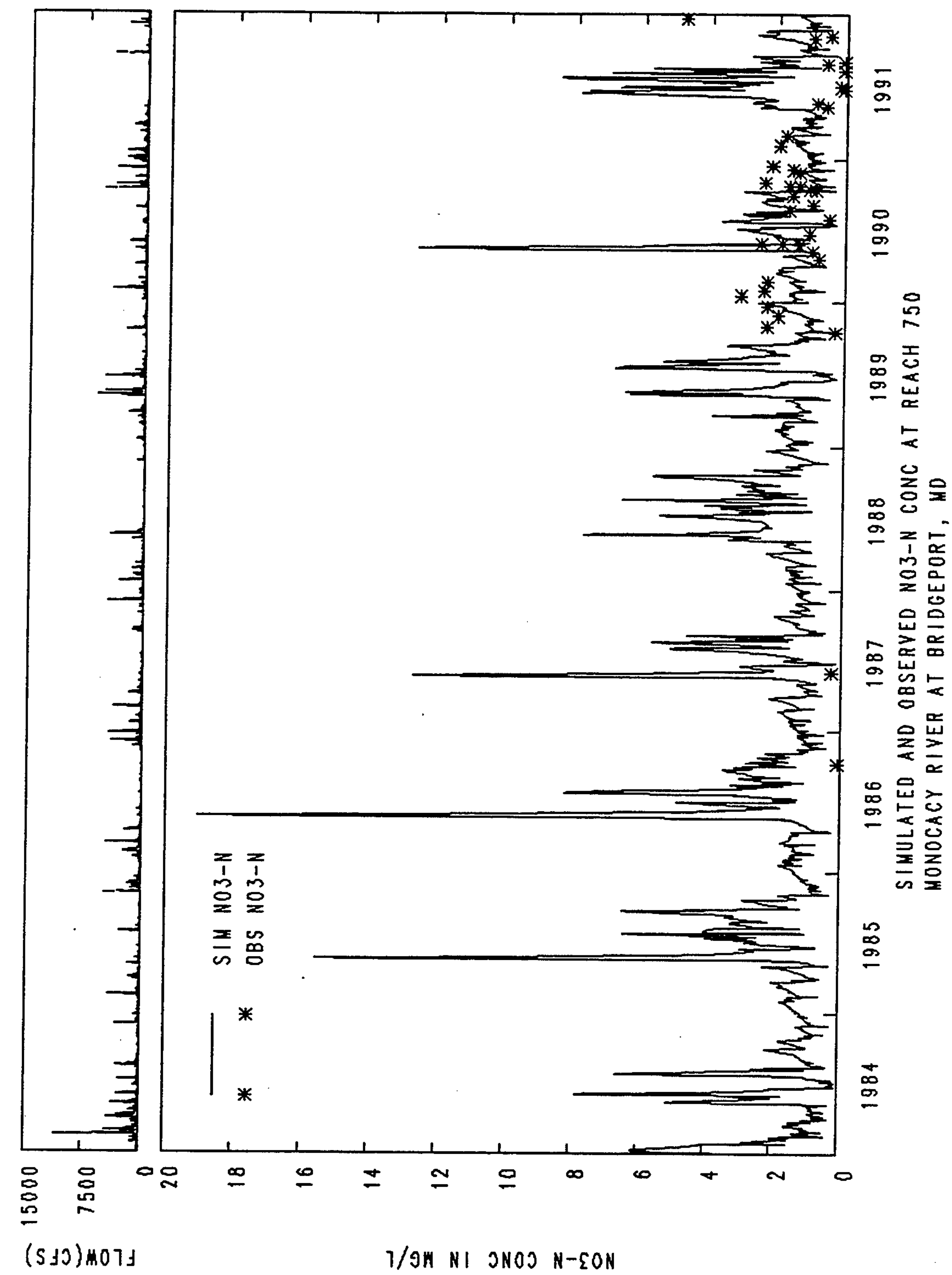
* - Observed Flow at Monocacy River at Bridgeport, MD
** - Simulated Outflow from RCH 750

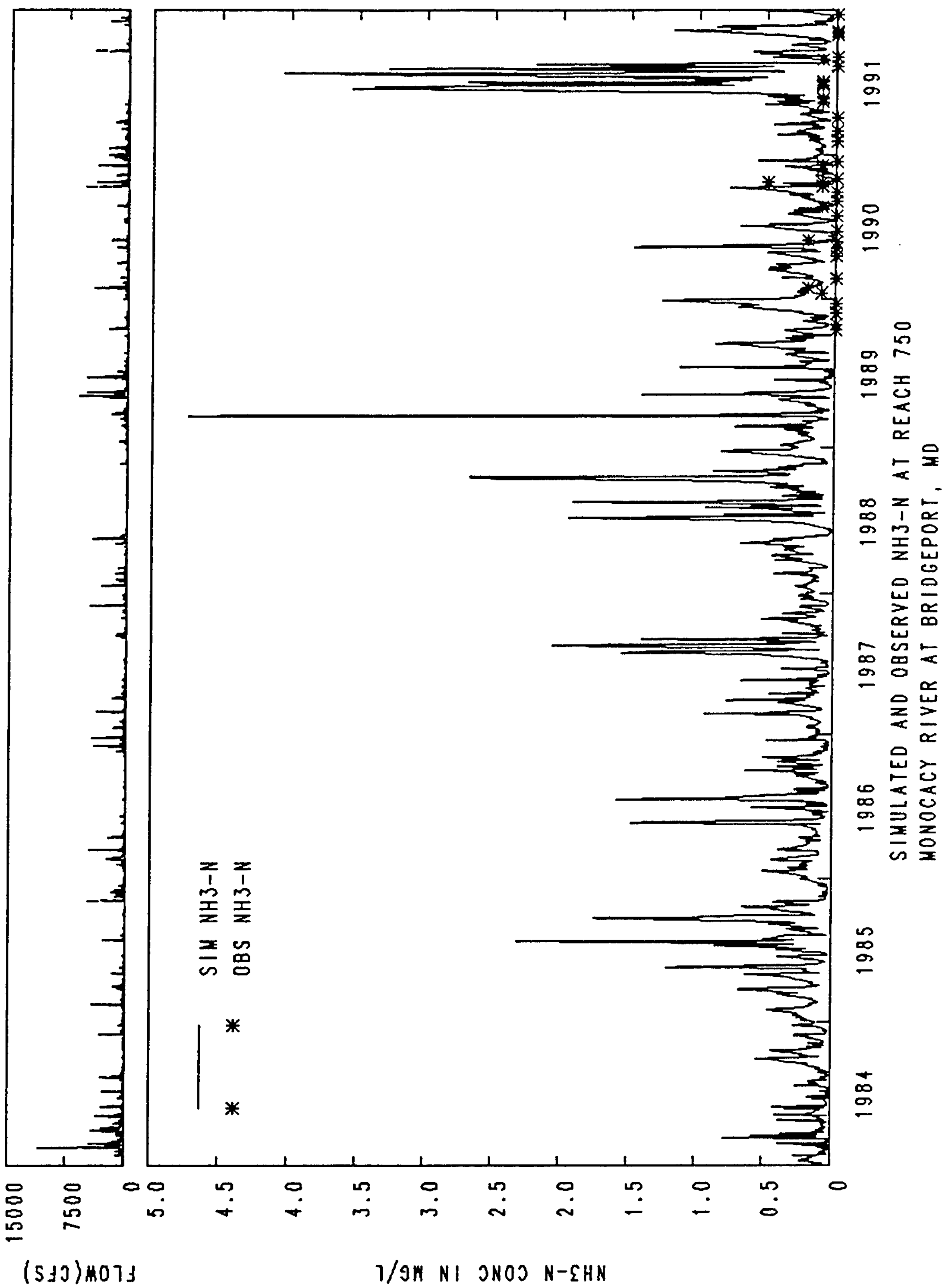

SIMULATED AND OBSERVED SEDIMENT CONC AT REACH 750
MONOCACY RIVER AT BRIDGEPORT, MD
SIM SED
OBS SED
FLOW(CFS)
SED CONC IN MG/L
15000
7500
0
1,000
900
800
700
600
500
400
300
200
100
0
1984
1985
1986
1987
1988
1989
1990
1991

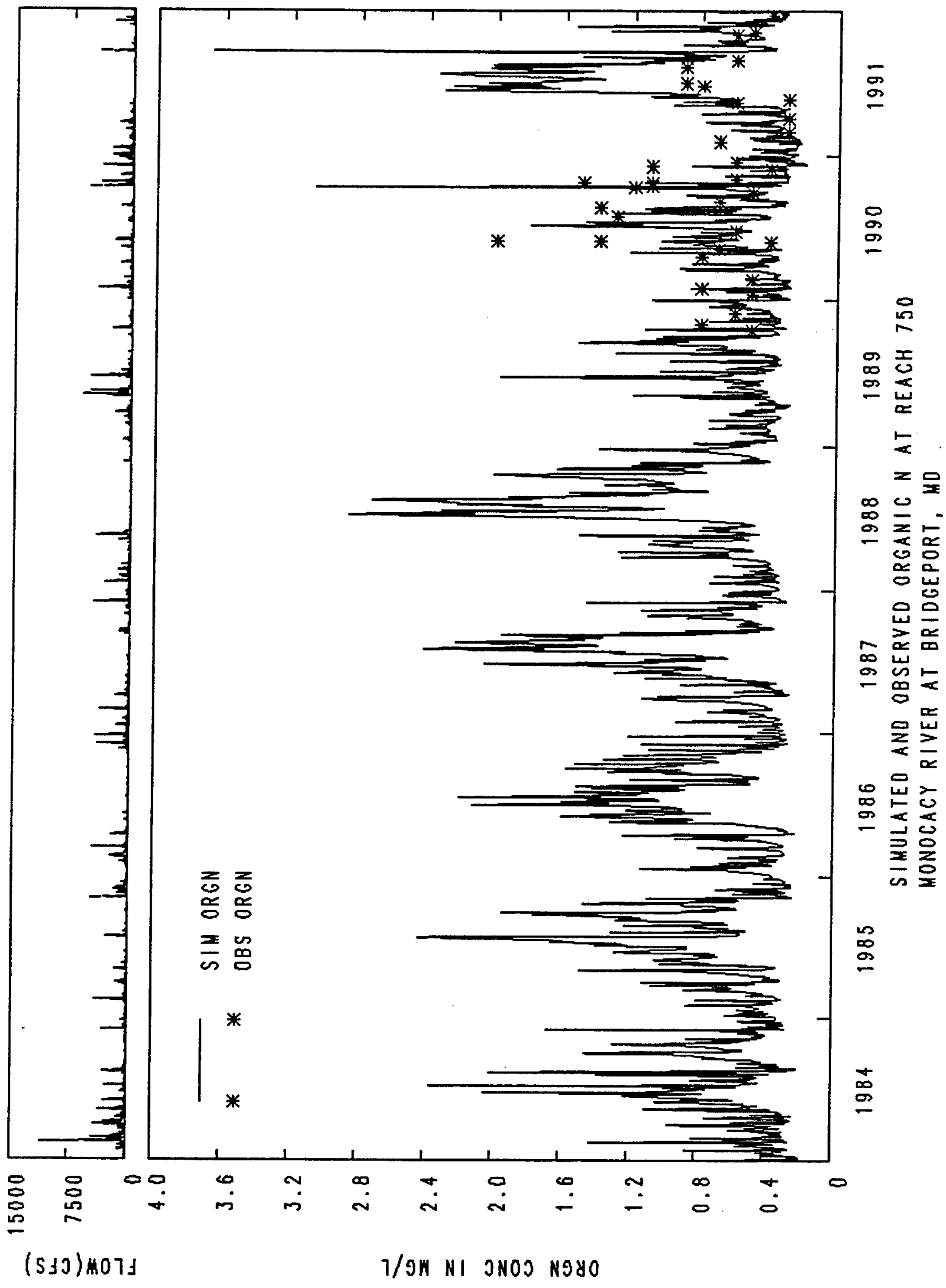

SIM WTEMP
OBS WTEMP
WATER TEMP IN DEG C
0
4
8
12
16
20
24
28
32
36
40
1984
1985
1986
1987
1988
1989
1990
1991
SIMULATED AND OBSERVED WATER TEMPERATUR AT REACH 200
MONOCACY RIVER AT BRIDGEPORT, MD



SIMULATED AND OBSERVED DO AT REACH 750
MONOCACY RIVER AT BRIDGEPORT, MD


SIMULATED AND OBSERVED NO3-N CONC AT REACH 750
MONOCACY RIVER AT BRIDGEPORT, MD
FLOW(CFS)
NO3-N CONC IN MG/L
SIM NO3-N
OBS NO3-N
15000
7500
0
20
18
16
14
12
10
8
6
4
2
0
1984
1985
1986
1987
1988
1989
1990
1991


FLOW(CFS)
15000
7500
0
NH3-N CONC IN MG/L
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
SIM NH3-N
OBS NH3-N
1984
1985
1986
1987
1988
1989
1990
1991
SIMULATED AND OBSERVED NH3-N AT REACH 750
MONOCACY RIVER AT BRIDGEPORT, MD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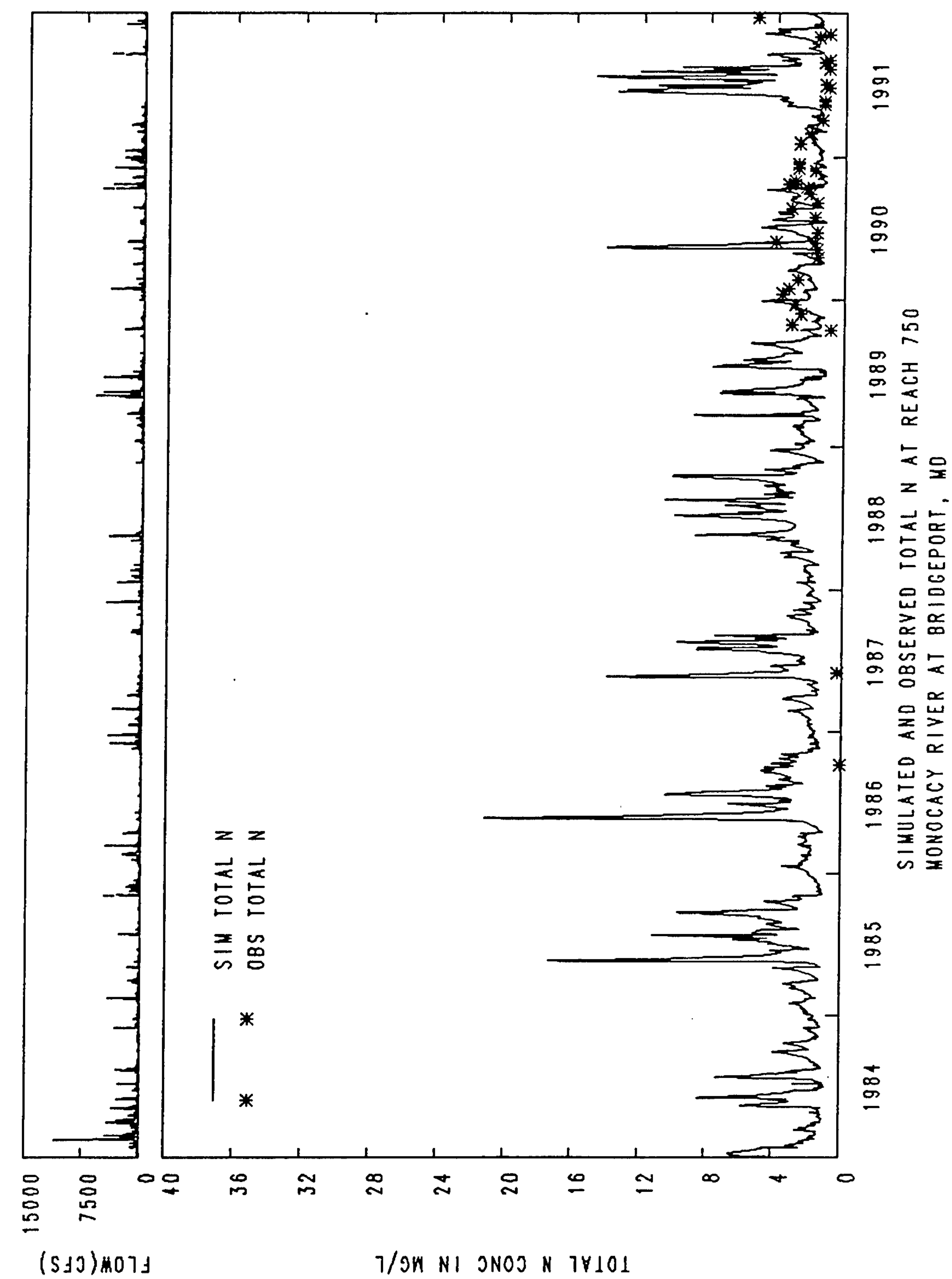
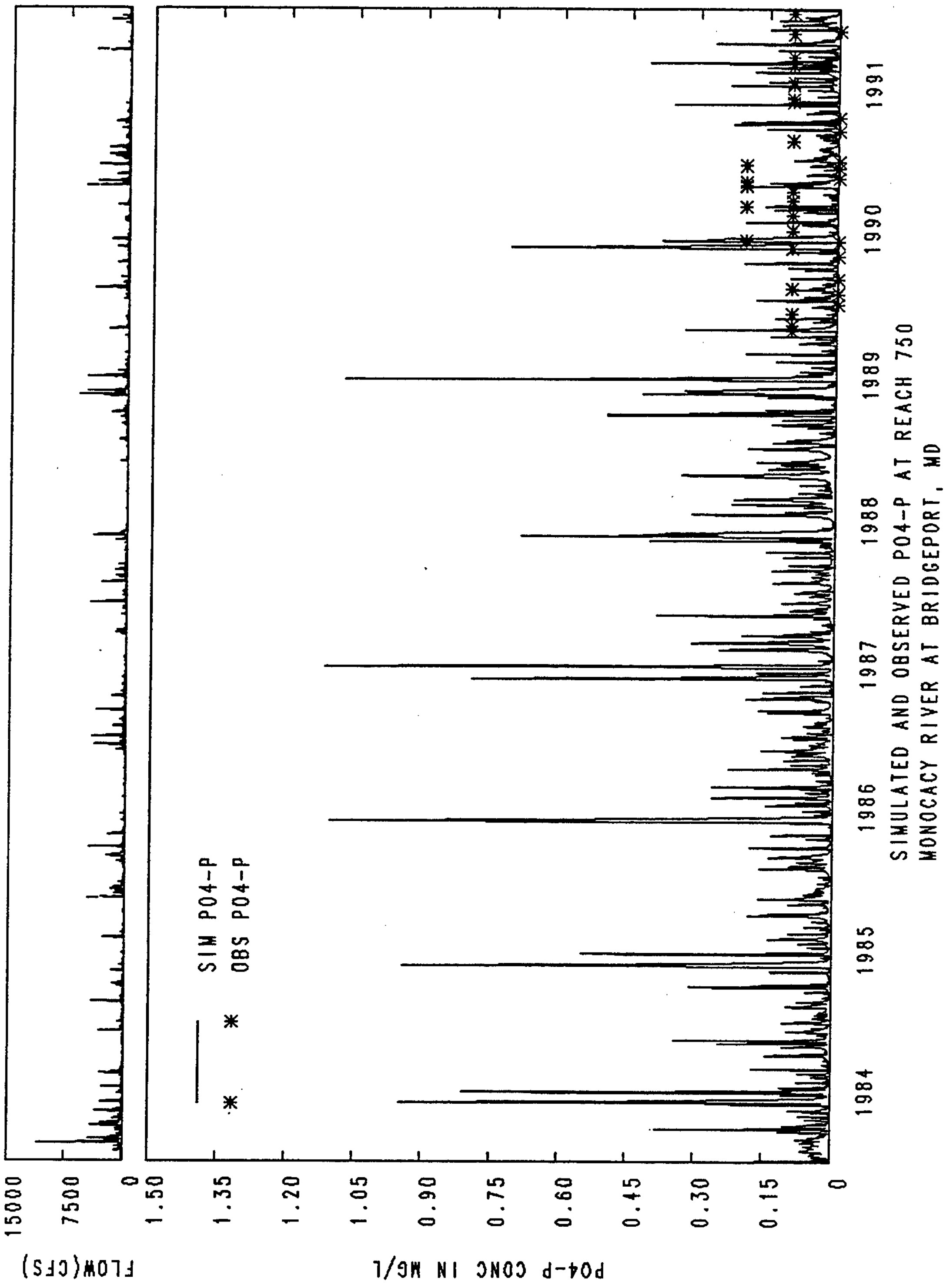
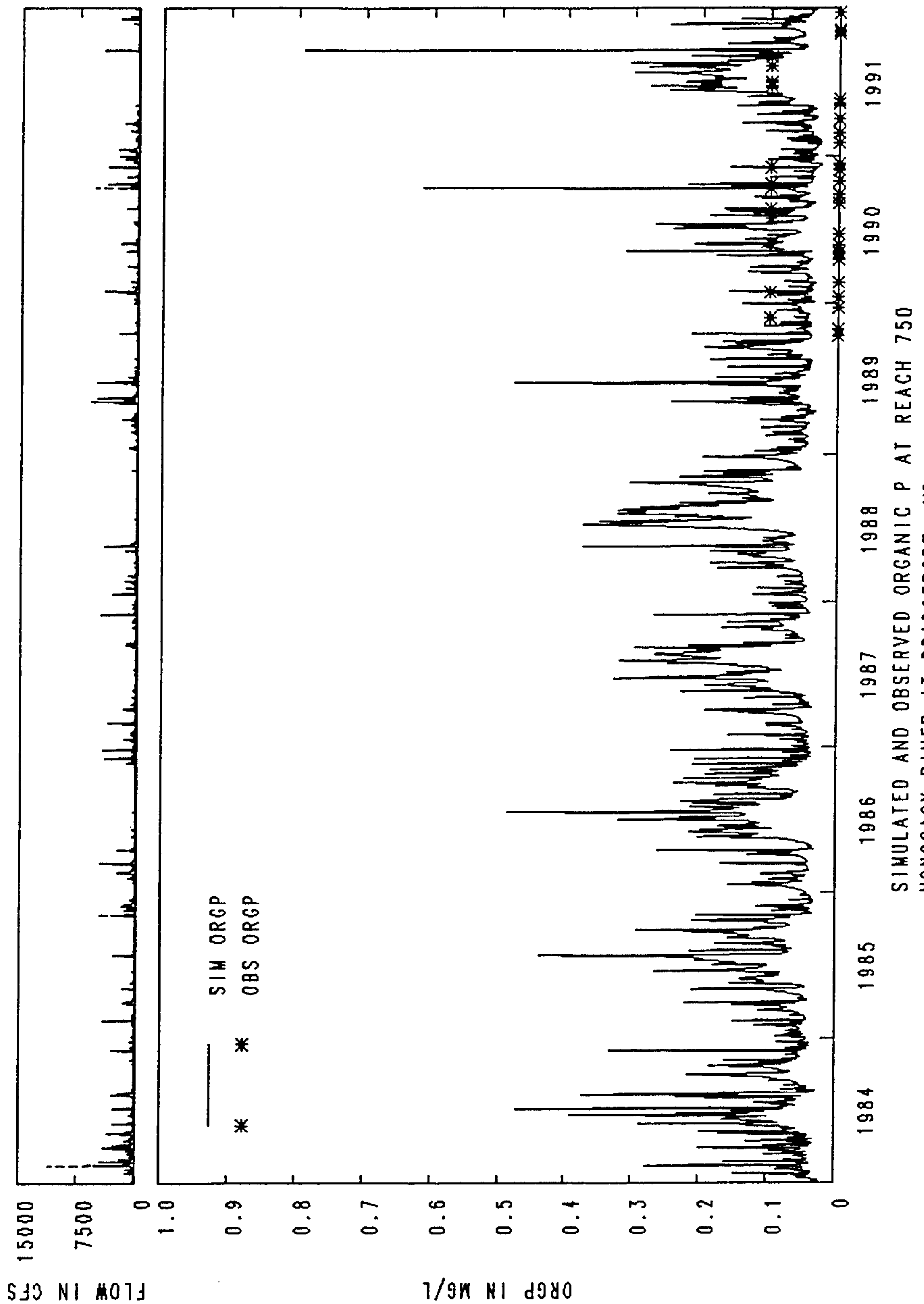
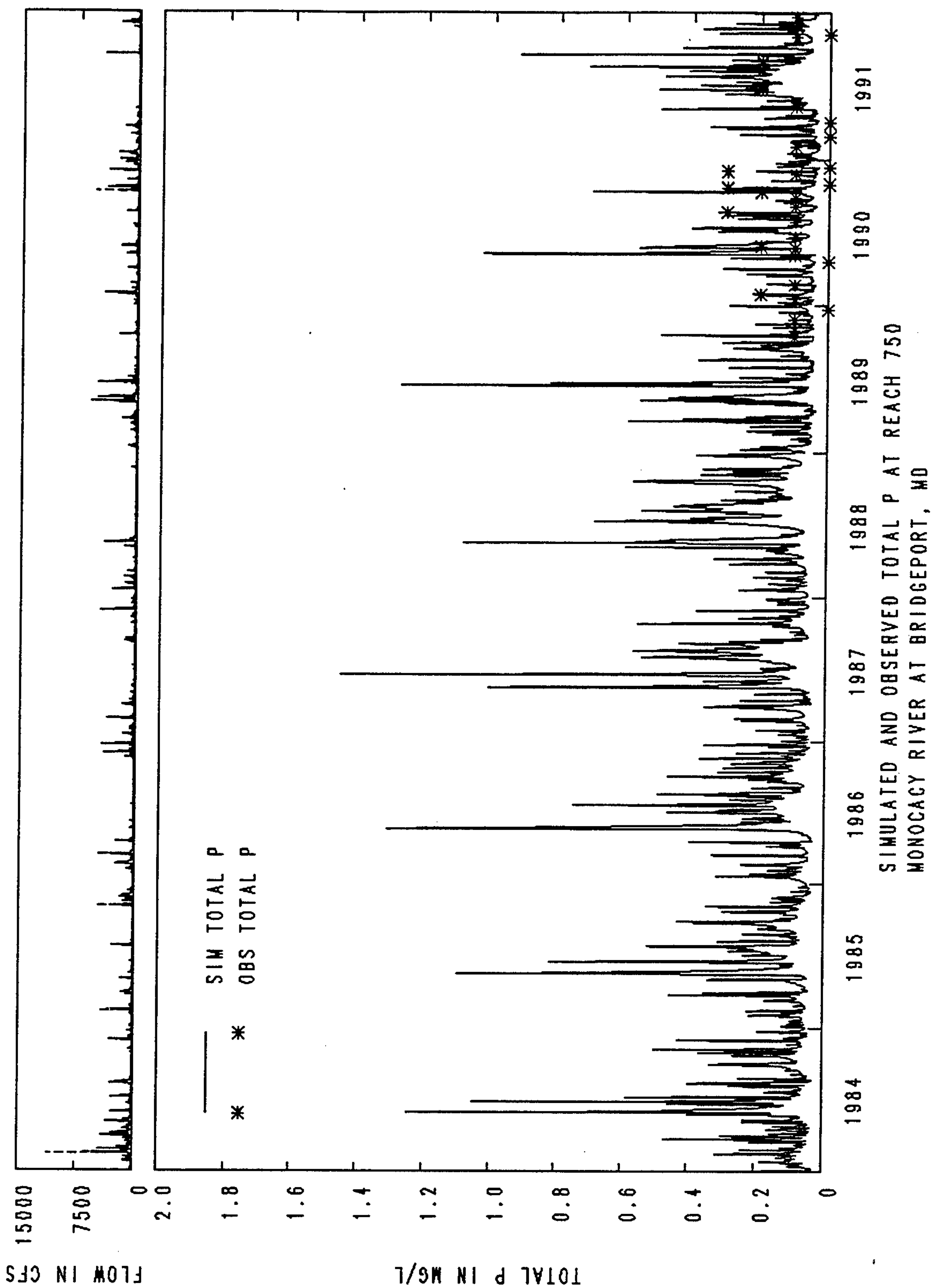
MONOCACY RIVER AT BRIDGEPORT, MD
FLOW(CFS)
ORGN CONC IN MG/L
SIM ORGN
OBS ORGN
15000
7500
0
4.0
3.6
3.2
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0
1984
1985
1986
1987
1988
1989
1990
1991

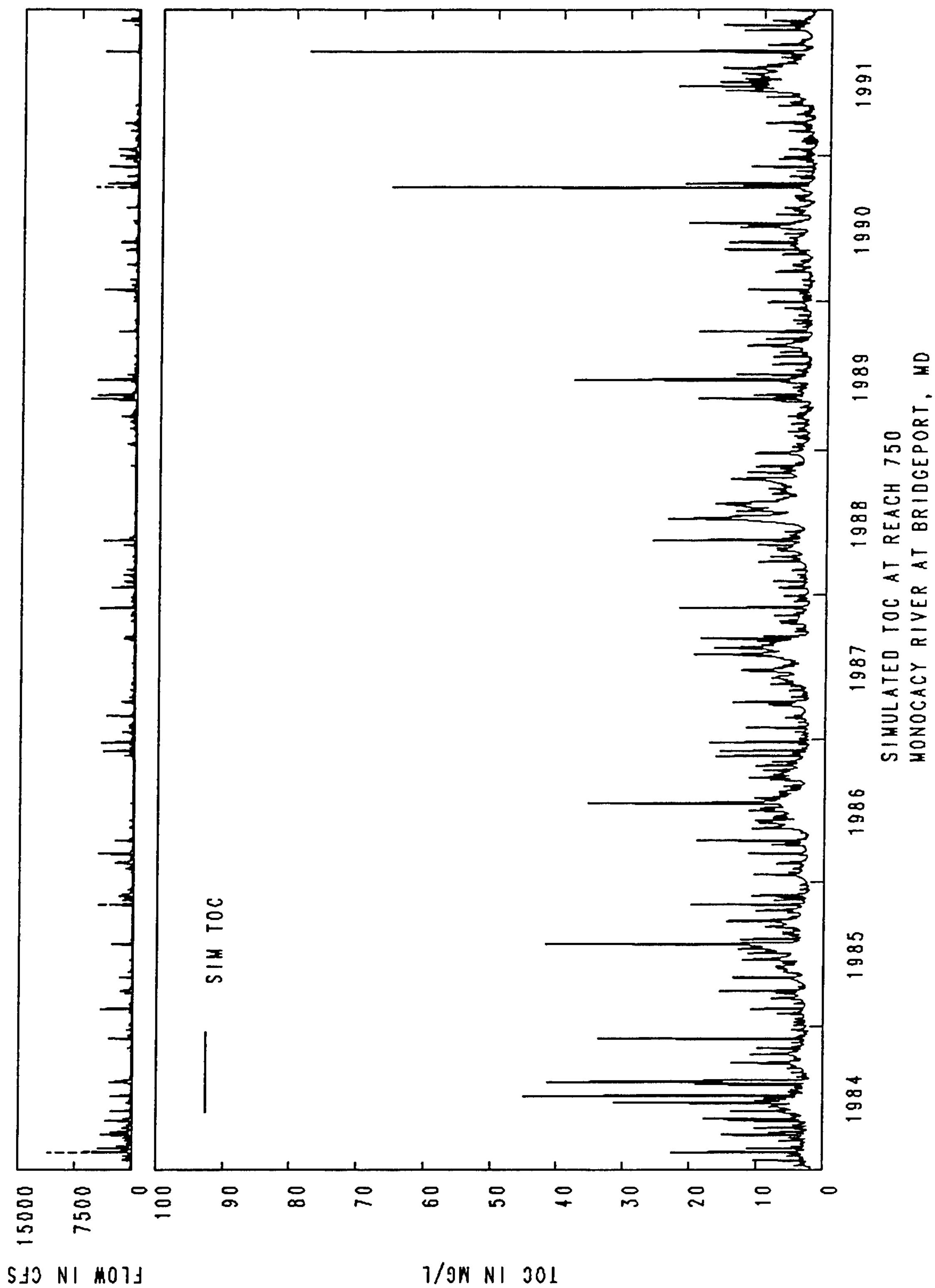

SIMULATED AND OBSERVED TOTAL N AT REACH 750
MONOCACY RIVER AT BRIDGEPORT, MD
SIM TOTAL N
OBS TOTAL N
FLOW(CFS)
TOTAL N CONC IN MG/L
15000
7500
0
40
36
32
28
24
20
16
12
8
4
0
1984
1985
1986
1987
1988
1989
1990
1991


SIMULATED AND OBSERVED PO4-P AT REACH 750
MONOCACY RIVER AT BRIDGEPORT, MD
FLOW(CFS)
15000
7500
0
PO4-P CONC IN MG/L
1.50
1.35
1.20
1.05
0.90
0.75
0.60
0.45
0.30
0.15
0
SIM PO4-P
OBS PO4-P
1984
1985
1986
1987
1988
1989
1990
1991

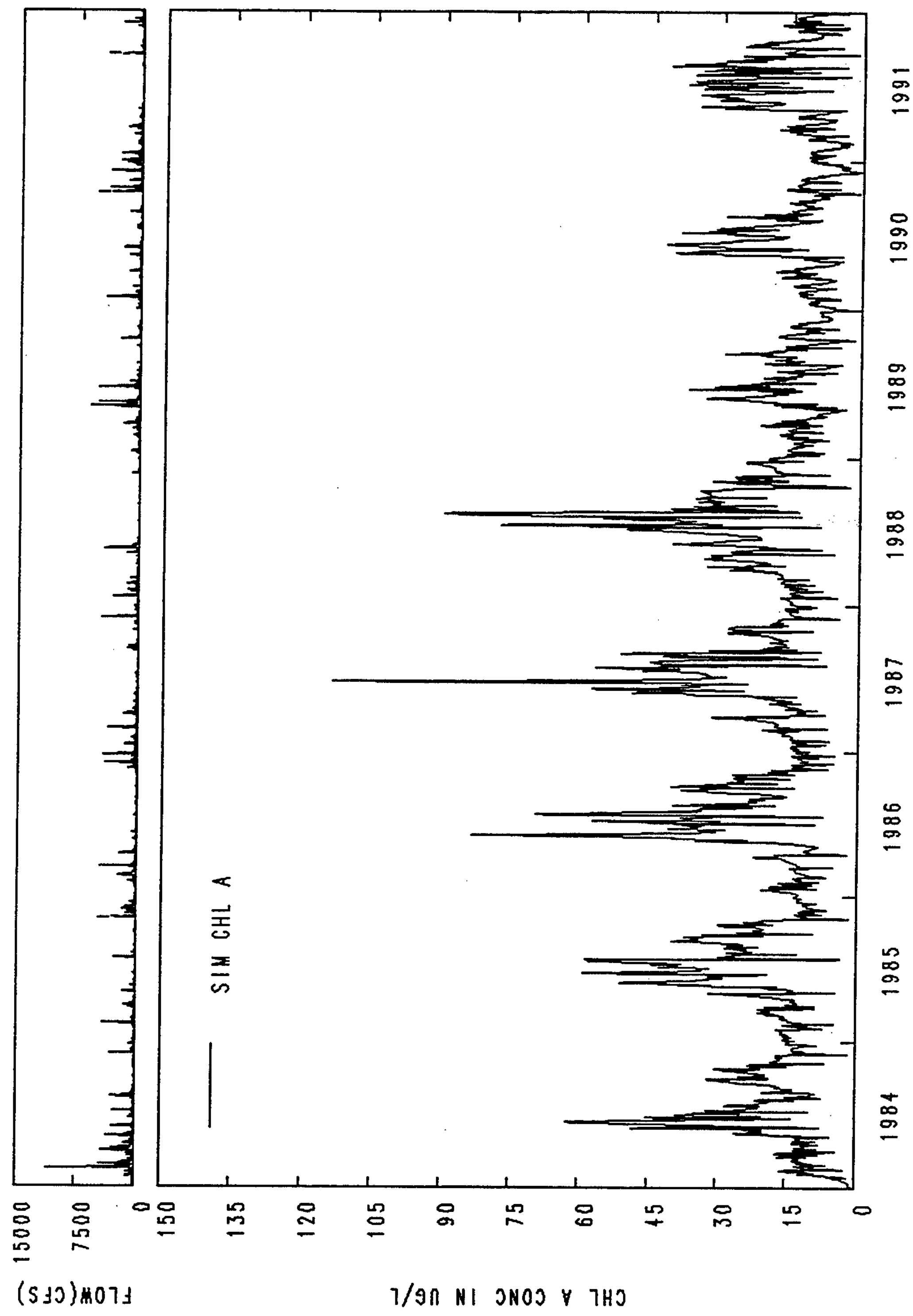

SIMULATED AND OBSERVED ORGANIC P AT REACH 750
MONOCACY RIVER AT BRIDGEPORT, MD
FLOW IN CFS
15000
7500
0
ORGP IN MG/L
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
SIM ORGP
OBS ORGP
1984
1985
1986
1987
1988
1989
1990
1991



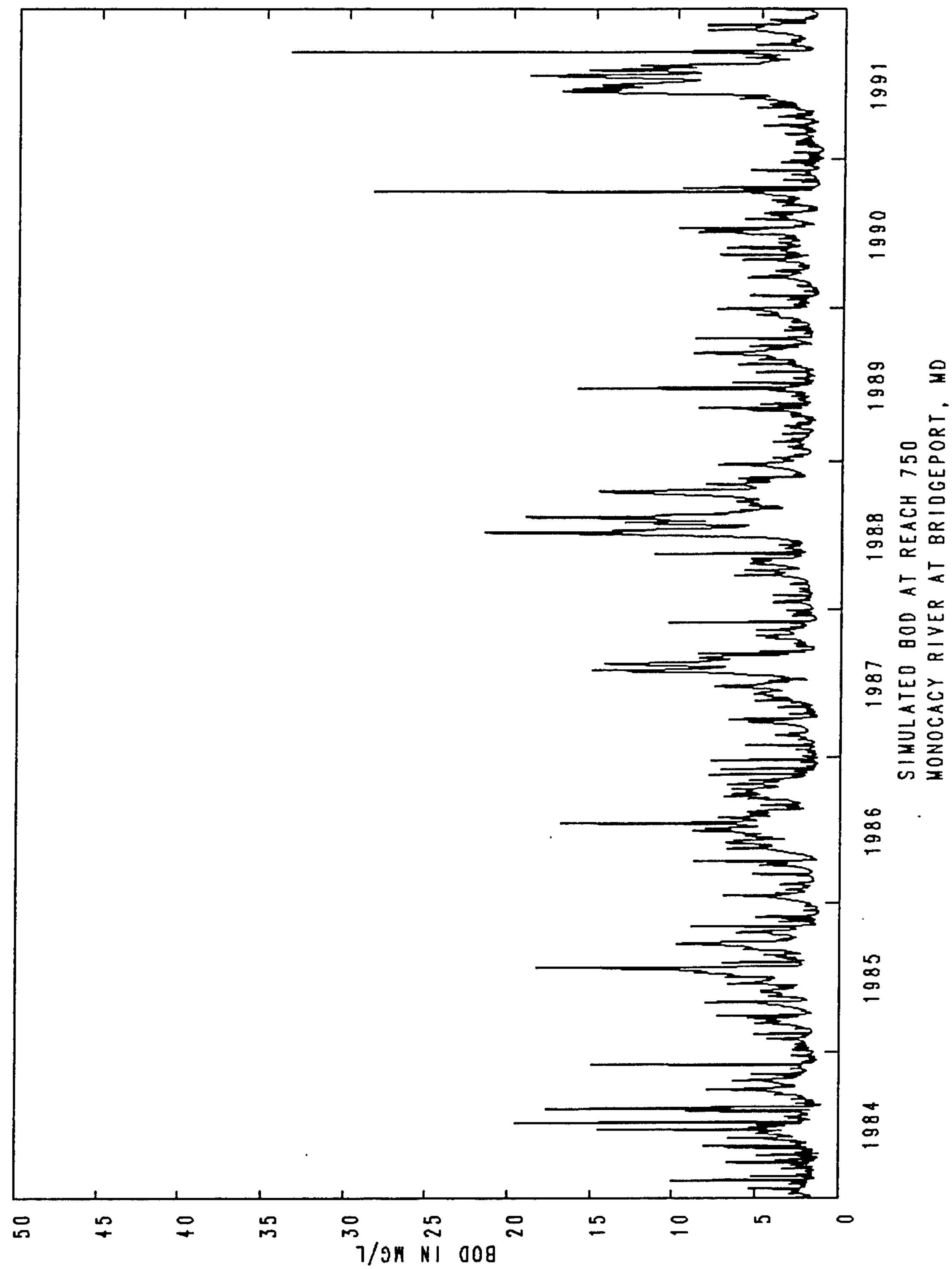
SIMULATED AND OBSERVED TOTAL P AT REACH 750
MONOCACY RIVER AT BRIDGEPORT, MD

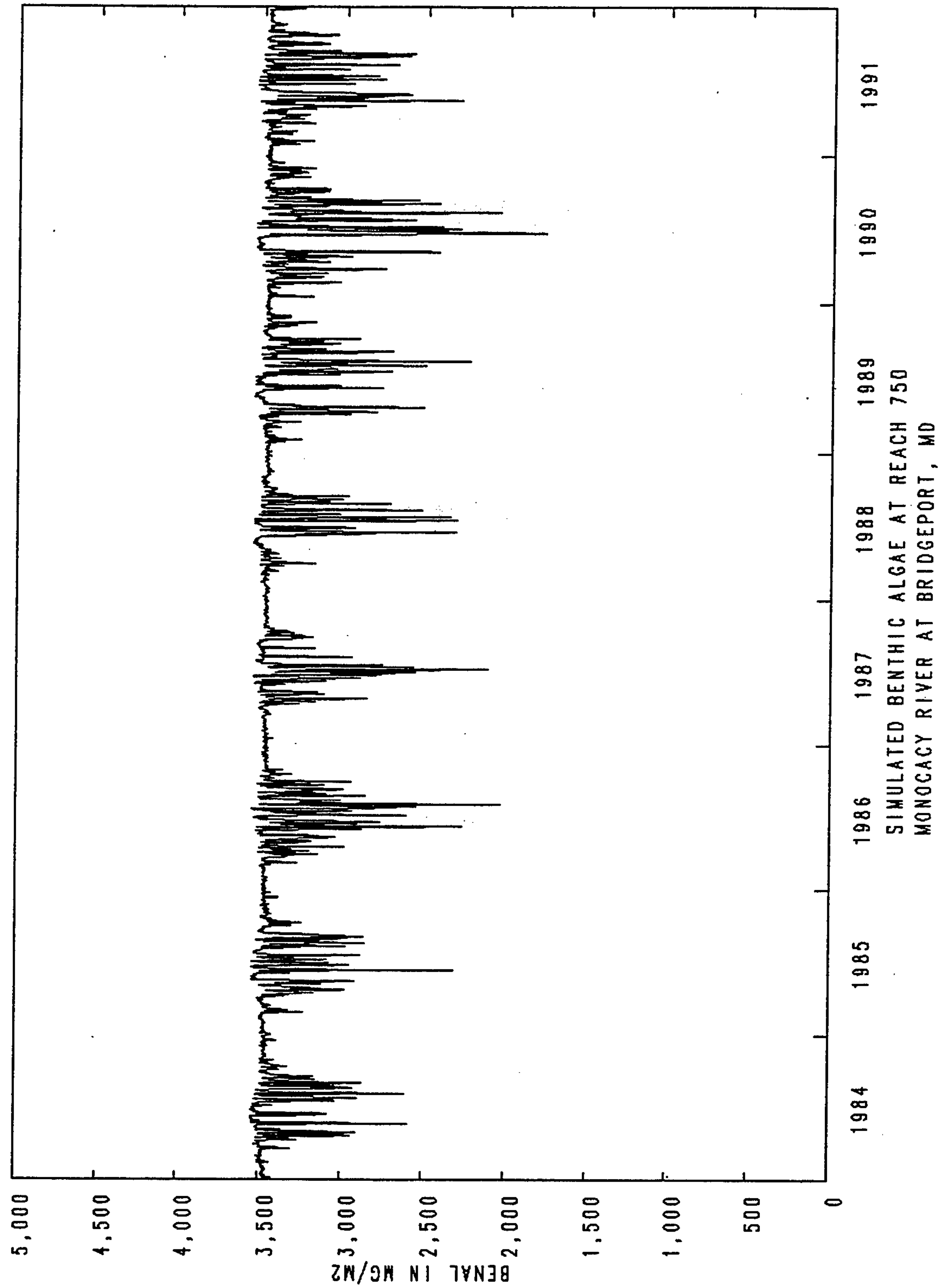


SIMULATED TOC AT REACH 750
MONOCACY RIVER AT BRIDGEPORT, MD
SIM TOC
FLOW IN CFS
TOC IN MG/L
15000
7500
0
100
90
80
70
60
50
40
30
20
10
0
1984
1985
1986
1987
1988
1989
1990
1991



SIMULATED CHLOROPHYLL A CONC AT REACH 750
MONOCACY RIVER AT BRIDGEPORT, MD


SIMULATED BOD AT REACH 750
MONOCACY RIVER AT BRIDGEPORT, MD
BOD IN MG/L
0
5
10
15
20
25
30
35
40
45
50
1984
1985
1986
1987
1988
1989
1990
1991


5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
BENAL IN MG/M2
1984
1985
1986
1987
1988
1989
1990
1991
SIMULATED BENTHIC ALGAE AT REACH 750
MONOCACY RIVER AT BRIDGEPORT, MD

AGCHEM RESULTS FOR MONOCACY (HI-TILL), SEGMENT 752

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	51.29	43.81	41.32	36.42	43.21
Runoff (in)					
Surface	13.81	6.576	6.166	3.858	7.603
Interflow	7.138	6.091	5.296	3.913	5.609
Baseflow	7.376	5.459	4.960	4.424	5.555
Total	28.32	18.13	16.42	12.20	18.77
Sediment Loss (t/a)	1.580	0.4100	0.5030	0.2150	0.6770
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.7088	0.2970	0.7321	0.2428	0.4952
Interflow	6.072	4.282	5.921	3.063	4.834
Baseflow	2.607	2.291	2.914	1.778	2.398
Total	9.388	6.870	9.567	5.084	7.727
NH3 Loss					
Surface	1.253	0.3140	1.058	0.3585	0.7459
Interflow	0.8140	1.708	2.373	1.190	1.521
Baseflow	0.5771E-01	0.3182E-01	0.2511E-01	0.1979E-01	0.3361E-01
Sediment	0.1763E-01	0.4260E-02	0.6639E-02	0.2295E-02	0.7706E-02
Total	2.143	2.058	3.462	1.570	2.308
ORGN Sediment	5.210	1.362	1.673	0.7046	2.237
Total N Loss (lb/a)	16.74	10.29	14.70	7.359	12.27
PO4 Loss					
Surface	0.5389	0.3601	0.3751	0.2952	0.3923
Interflow	0.5132	0.6885	0.5537	0.3798	0.5338
Baseflow	0.3594E-02	0.1055E-03	0.1034E-03	0.8366E-04	0.9716E-03
Sediment	0.6666E-01	0.1782E-01	0.2230E-01	0.9416E-02	0.2905E-01
Total	1.122	1.066	0.9512	0.6846	0.9560
ORGP Sediment	1.445	0.3773	0.4638	0.1955	0.6204
Total P Loss (lb/a)	2.567	1.444	1.415	0.8801	1.577
Atm Depn. NO3 (lb/a)	7.739	6.932	6.840	6.777	7.072
Atm Depn. NH4 (lb/a)	2.434	1.971	1.875	1.871	2.038
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	82.38	84.25	84.44	84.25	83.83
Nitrate appln.(lb/a)	23.66	24.28	24.35	24.29	24.15
ORGN appln.(lb/a)	14.82	14.82	14.82	14.82	14.82
Total N appln.(lb/a)	120.9	123.4	123.6	123.4	122.8
PO4-p appln.(lb/a)	30.50	30.10	30.50	30.12	30.31
ORGP appln.(lb/a)	3.720	3.720	3.720	3.720	3.720
Total P appln.(lb/a)	34.22	33.83	34.22	33.84	34.03
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.1600E-01	0.8000E-02	0.6000E-02	0.1300E-01	0.1075E-01
Upper	65.71	61.67	56.43	69.19	63.25
Lower	30.28	44.02	44.03	43.28	40.40
Total	96.00	105.7	100.5	112.5	103.7
Phosphorus					
Surface	0.1700E-01	0.1000E-01	0.7000E-02	0.1300E-01	0.1175E-01
Upper	21.34	22.56	23.33	22.51	22.44
Lower	2.802	2.801	2.801	2.801	2.801
Total	24.15	25.37	26.14	25.33	25.25
Deficit (lb/a)					
Nitrogen					
Surface	1.385	1.393	1.394	1.388	1.390
Upper	29.26	33.34	38.56	25.80	31.74
Lower	13.87	0.0000	0.0000	0.7628	3.658
Total	44.52	34.73	39.96	27.95	36.79
Phosphorus					
Surface	1.384	1.391	1.394	1.388	1.389
Upper	2.503	1.258	0.4931	1.316	1.393
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	3.887	2.649	1.887	2.704	2.782
Other Fluxes-lb/ac					
N Mineralization	11.39	17.20	17.68	17.71	16.00
P Mineralization	3.369	3.401	3.191	3.335	3.324
Denitrification	0.4882	1.479	2.403	1.128	1.375
N Immobilization	16.43	17.45	17.78	17.24	17.23
P Immobilization	7.382	7.332	6.536	7.314	7.141

AGCHEM RESULTS FOR MONOCACY (HI-TILL), SEGMENT 752

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	33.14	43.14	47.51	35.54	39.83
Runoff (in)					
Surface	3.488	7.489	7.742	4.250	5.742
Interflow	3.480	5.627	6.041	3.603	4.688
Baseflow	3.747	5.729	5.450	4.078	4.751
Total	10.72	18.84	19.23	11.93	15.18
Sediment Loss (t/a)	0.2520	0.7540	0.8790	0.8490	0.6835
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.2096	0.6335	0.3276	0.1863	0.3393
Interflow	7.833	12.88	5.870	1.849	7.108
Baseflow	1.446	1.851	2.198	0.8826	1.594
Total	9.488	15.36	8.396	2.918	9.040
NH3 Loss					
Surface	0.3251	2.126	0.7119	0.4568	0.9049
Interflow	1.501	2.371	1.788	0.7545	1.604
Baseflow	0.1550E-01	0.2147E-01	0.1820E-01	0.1248E-01	0.1691E-01
Sediment	0.2763E-02	0.8719E-02	0.9741E-02	0.9956E-02	0.7795E-02
Total	1.844	4.527	2.528	1.234	2.533
ORGN Sediment	0.8249	2.515	2.958	2.873	2.293
Total N Loss (lb/a)	12.16	22.41	13.88	7.025	13.87
PO4 Loss					
Surface	0.4544	0.7169	0.7914	0.3300	0.5732
Interflow	0.6905	0.8664	0.7867	0.2653	0.6522
Baseflow	0.6930E-04	0.1100E-03	0.1040E-03	0.6221E-04	0.8638E-04
Sediment	0.1233E-01	0.3444E-01	0.4175E-01	0.3930E-01	0.3196E-01
Total	1.157	1.618	1.620	0.6347	1.257
ORGP Sediment	0.2284	0.6964	0.8206	0.7986	0.6360
Total P Loss (lb/a)	1.386	2.314	2.441	1.433	1.893
Atm Depn. NO3 (lb/a)	6.527	7.305	7.390	6.621	6.961
Atm Depn. NH4 (lb/a)	1.767	2.315	2.235	1.752	2.017
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	82.43	84.30	83.55	82.49	83.19
Nitrate appln.(lb/a)	23.68	24.30	24.05	23.70	23.94
ORGN appln.(lb/a)	14.82	14.82	14.82	14.82	14.82
Total N appln.(lb/a)	120.9	123.4	122.4	121.0	121.9
PO4-p appln.(lb/a)	30.50	30.22	30.02	29.57	30.08
ORGP appln.(lb/a)	3.720	3.720	3.720	3.720	3.720
Total P appln.(lb/a)	34.22	33.94	33.74	33.30	33.80
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.8000E-02	0.1900E-01	0.2100E-01	0.1000E-01	0.1450E-01
Upper	58.83	56.23	60.50	64.47	60.01
Lower	41.66	38.16	44.04	44.03	41.97
Total	100.5	94.41	104.6	108.5	102.0
Phosphorus					
Surface	0.8000E-02	0.2000E-01	0.1900E-01	0.1200E-01	0.1475E-01
Upper	23.10	21.12	22.26	23.71	22.55
Lower	2.802	2.801	2.801	2.801	2.801
Total	25.91	23.94	25.08	26.53	25.36
Deficit (lb/a)					
Nitrogen					
Surface	1.393	1.382	1.379	1.390	1.386
Upper	36.15	38.75	34.48	30.54	34.98
Lower	2.380	5.879	0.0000	0.0000	2.065
Total	39.92	46.01	35.86	31.93	38.43
Phosphorus					
Surface	1.393	1.381	1.381	1.389	1.386
Upper	0.7296	2.703	1.561	0.9997E-01	1.273
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	2.123	4.084	2.943	1.489	2.660
Other Fluxes-lb/ac					
N Mineralization	16.36	14.49	17.02	16.82	16.17
P Mineralization	3.238	3.313	3.461	3.266	3.319
Denitrification	1.111	0.9720	1.260	0.6708	1.003
N Immobilization	17.66	17.38	17.76	17.39	17.55
P Immobilization	6.513	9.044	7.789	4.804	7.037

AGCHEM RESULTS FOR MONOCACY (LOW-TILL), SEGMENT 753

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	51.29	43.81	41.32	36.42	43.21
Runoff (in)					
Surface	12.30	5.171	4.758	2.429	6.165
Interflow	7.066	6.069	5.112	3.585	5.458
Baseflow	7.924	5.826	5.340	4.801	5.973
Total	27.29	17.07	15.21	10.82	17.60
Sediment Loss (t/a)	0.7950	0.1880	0.2040	0.8113E-01	0.3170
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.5735	0.2150	0.4224	0.1391	0.3375
Interflow	7.786	5.197	4.376	2.794	5.038
Baseflow	2.585	1.819	1.475	0.8033	1.671
Total	10.94	7.231	6.273	3.737	7.045
NH3 Loss					
Surface	1.126	0.2392	0.7134	0.2641	0.5857
Interflow	0.7194	1.424	1.843	0.8689	1.214
Baseflow	0.6094E-01	0.3249E-01	0.2554E-01	0.2020E-01	0.3479E-01
Sediment	0.8813E-02	0.1889E-02	0.2266E-02	0.7938E-03	0.3440E-02
Total	1.915	1.698	2.584	1.154	1.838
ORGN Sediment	3.278	0.7620	0.8339	0.3179	1.298
Total N Loss (lb/a)	16.14	9.691	9.691	5.209	10.18
PO4 Loss					
Surface	0.6201	0.3529	0.3944	0.2673	0.4087
Interflow	0.5264	0.3647	0.2850	0.1995	0.3439
Baseflow	0.3622E-02	0.9870E-04	0.8703E-04	0.6173E-04	0.9674E-03
Sediment	0.3354E-01	0.7960E-02	0.8783E-02	0.3363E-02	0.1341E-01
Total	1.184	0.7256	0.6883	0.4702	0.7670
ORGP Sediment	0.8733	0.2030	0.2224	0.8488E-01	0.3459
Total P Loss (lb/a)	2.057	0.9286	0.9107	0.5550	1.113
Atm Depn. NO3 (lb/a)	7.739	6.932	6.840	6.777	7.072
Atm Depn. NH4 (lb/a)	2.434	1.971	1.875	1.871	2.038
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	90.66	92.02	92.32	92.03	91.76
Nitrate appln.(lb/a)	26.51	26.97	27.07	26.97	26.88
ORGN appln.(lb/a)	14.64	14.64	14.64	14.64	14.64
Total N appln.(lb/a)	131.8	133.6	134.0	133.6	133.3
PO4-p appln.(lb/a)	32.08	31.47	32.08	31.49	31.78
ORGP appln.(lb/a)	3.660	3.660	3.660	3.660	3.660
Total P appln.(lb/a)	35.74	35.13	35.74	35.15	35.44
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.3700E-01	0.2200E-01	0.1100E-01	0.2100E-01	0.2275E-01
Upper	72.09	67.10	67.20	78.64	71.26
Lower	30.88	45.17	45.77	36.78	39.65
Total	103.0	112.3	113.0	115.4	110.9
Phosphorus					
Surface	0.3100E-01	0.2000E-01	0.1000E-01	0.2200E-01	0.2075E-01
Upper	21.53	22.46	23.38	22.54	22.48
Lower	2.802	2.801	2.801	2.801	2.801
Total	24.37	25.28	26.19	25.36	25.30
Deficit (lb/a)					
Nitrogen					
Surface	1.515	1.528	1.539	1.529	1.528
Upper	33.06	38.06	37.97	26.53	33.90
Lower	17.96	3.610	3.009	11.95	9.132
Total	52.54	43.20	42.51	40.01	44.56
Phosphorus					
Surface	1.370	1.380	1.390	1.379	1.380
Upper	2.287	1.372	0.4359	1.276	1.343
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	3.657	2.752	1.826	2.655	2.722
Other Fluxes-lb/ac					
N Mineralization	11.10	14.18	15.20	13.32	13.45
P Mineralization	3.769	3.635	3.526	3.538	3.617
Denitrification	0.4637	1.251	1.538	0.6172	0.9675
N Immobilization	18.78	19.58	20.22	19.60	19.55
P Immobilization	11.82	9.740	9.164	10.00	10.18

AGCHEM RESULTS FOR MONOCACY (LOW-TILL), SEGMENT 753

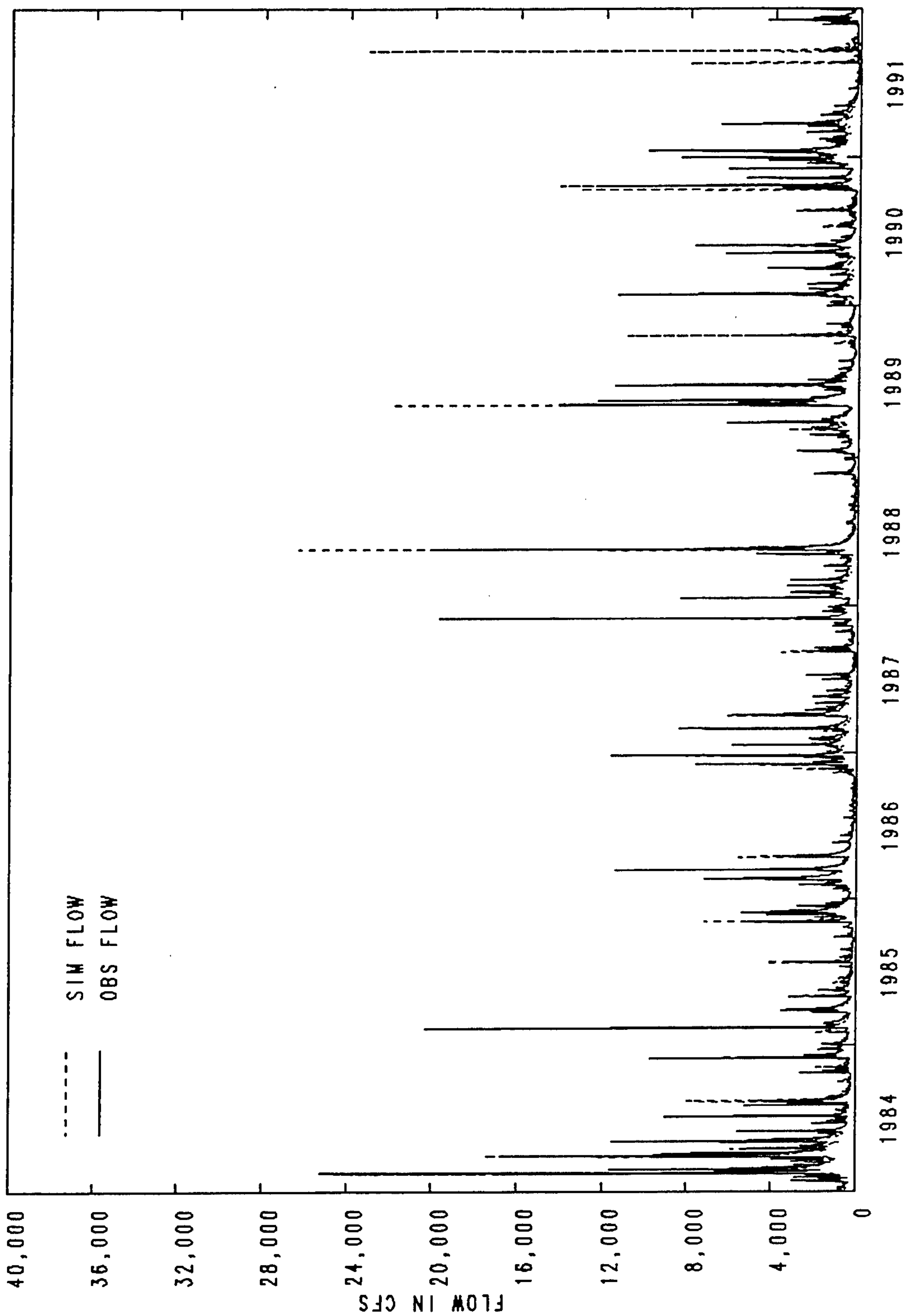
	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	33.14	43.14	47.51	35.54	39.83
Runoff (in)					
Surface	2.648	5.992	6.352	3.267	4.565
Interflow	3.397	5.544	5.800	3.441	4.545
Baseflow	3.893	6.166	5.836	4.337	5.058
Total	9.938	17.70	17.99	11.05	14.17
Sediment Loss (t/a)	0.1130	0.3540	0.4060	0.3720	0.3113
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.1754	0.4723	0.3152	0.1266	0.2724
Interflow	10.24	14.52	7.172	0.9132	8.211
Baseflow	1.622	1.789	2.174	0.4732	1.515
Total	12.03	16.79	9.661	1.513	9.999
NH3 Loss					
Surface	0.4784	1.611	0.7121	0.3794	0.7952
Interflow	1.352	2.135	1.603	0.6516	1.435
Baseflow	0.1500E-01	0.2141E-01	0.1770E-01	0.1204E-01	0.1654E-01
Sediment	0.1225E-02	0.4066E-02	0.4478E-02	0.4251E-02	0.3505E-02
Total	1.846	3.772	2.337	1.047	2.250
ORGN Sediment	0.4472	1.445	1.689	1.564	1.286
Total N Loss (lb/a)	14.33	22.00	13.69	4.125	13.54
PO4 Loss					
Surface	0.7032	0.8938	0.9163	0.3152	0.7071
Interflow	0.6922	0.8127	0.5521	0.1360	0.5483
Baseflow	0.4490E-04	0.6669E-04	0.5455E-04	0.2724E-04	0.4834E-04
Sediment	0.5765E-02	0.1617E-01	0.1914E-01	0.1721E-01	0.1457E-01
Total	1.401	1.723	1.488	0.4684	1.270
ORGP Sediment	0.1194	0.3855	0.4518	0.4194	0.3440
Total P Loss (lb/a)	1.521	2.108	1.939	0.8878	1.614
Atm Depn. NO3 (lb/a)	6.527	7.305	7.390	6.621	6.961
Atm Depn. NH4 (lb/a)	1.767	2.315	2.235	1.752	2.017
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	89.89	92.11	91.24	90.12	90.84
Nitrate appln.(lb/a)	26.26	27.00	26.71	26.34	26.58
ORGN appln.(lb/a)	14.64	14.64	14.64	14.64	14.64
Total N appln.(lb/a)	130.8	133.7	132.6	131.1	132.1
PO4-p appln.(lb/a)	32.08	31.65	31.50	30.96	31.55
ORGP appln.(lb/a)	3.660	3.660	3.660	3.660	3.660
Total P appln.(lb/a)	35.74	35.31	35.16	34.62	35.21
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.1500E-01	0.4100E-01	0.3100E-01	0.1300E-01	0.2500E-01
Upper	62.41	61.90	65.52	80.89	67.68
Lower	42.85	38.95	44.06	34.53	40.10
Total	105.3	100.9	109.6	115.4	107.8
Phosphorus					
Surface	0.1300E-01	0.3400E-01	0.2400E-01	0.1300E-01	0.2100E-01
Upper	22.95	20.45	21.54	23.72	22.16
Lower	2.802	2.801	2.801	2.801	2.801
Total	25.77	23.28	24.36	26.53	24.99
Deficit (lb/a)					
Nitrogen					
Surface	1.536	1.510	1.520	1.538	1.526
Upper	42.74	43.26	39.64	24.27	37.48
Lower	5.936	9.843	4.741	14.20	8.680
Total	50.22	54.62	45.90	40.01	47.69
Phosphorus					
Surface	1.388	1.366	1.376	1.388	1.380
Upper	0.8720	3.375	2.288	0.9997E-01	1.659
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	2.260	4.742	3.664	1.488	3.038
Other Fluxes-lb/ac					
N Mineralization	15.44	13.29	14.64	13.04	14.10
P Mineralization	3.349	3.586	3.655	3.581	3.543
Denitrification	1.094	0.8500	1.195	0.2743	0.8533
N Immobilization	19.58	19.64	20.01	19.28	19.63
P Immobilization	8.305	11.19	10.21	5.941	8.911

AGCHEM RESULTS FOR MONOCACY (HAY), SEGMENT 756

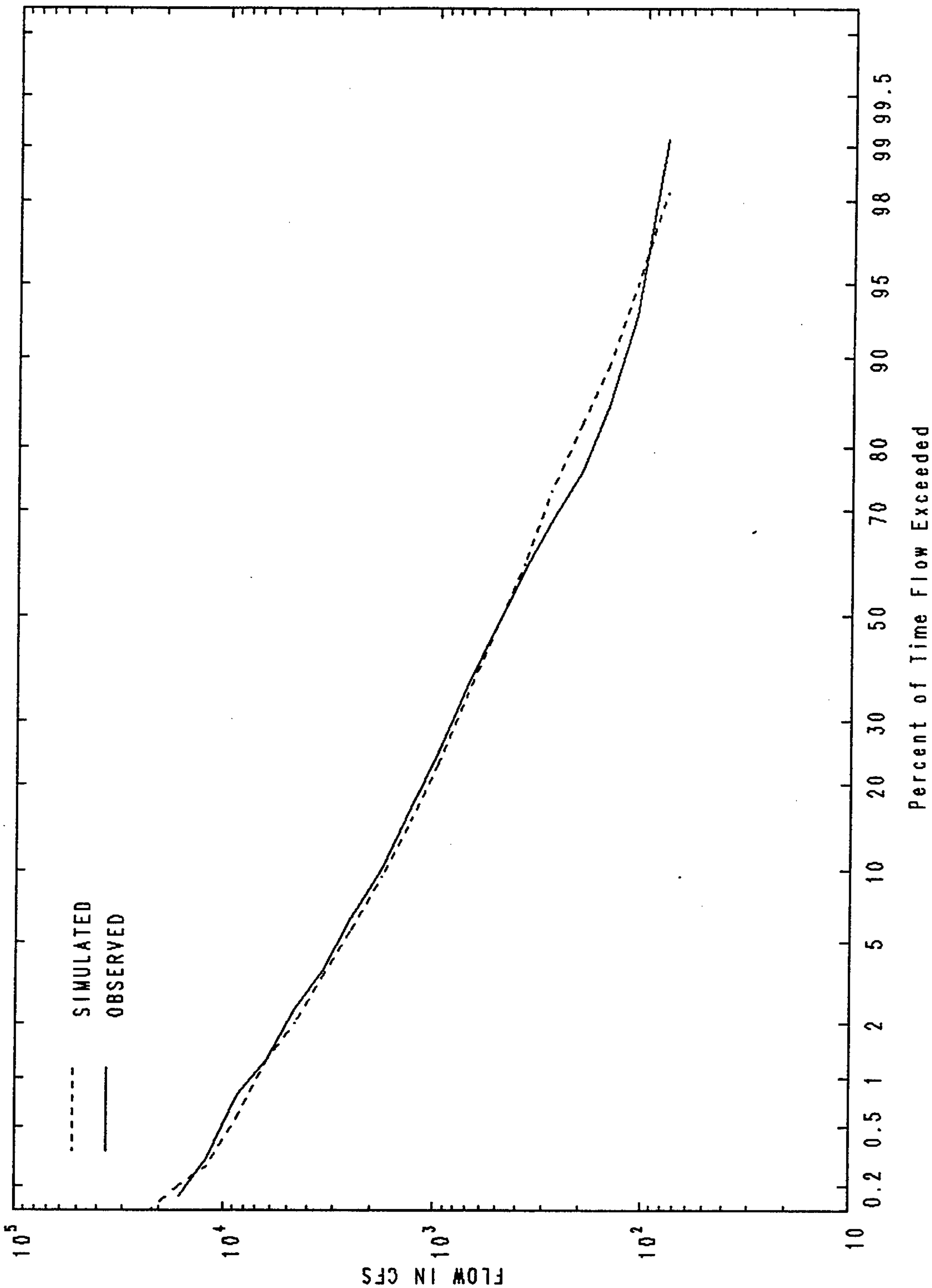
	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	51.29	43.81	41.32	36.42	43.21
Runoff (in)					
Surface	14.16	6.342	5.359	3.154	7.254
Interflow	4.439	3.643	3.158	2.122	3.340
Baseflow	7.616	5.318	5.038	4.517	5.622
Total	26.22	15.30	13.56	9.792	16.22
Sediment Loss (t/a)	0.5890	0.1720	0.1460	0.7267E-01	0.2449
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.7388	0.2910	0.2948	0.1867	0.3778
Interflow	0.8894	0.4733	0.5627	0.2904	0.5540
Baseflow	3.134	1.884	2.609	2.412	2.510
Total	4.763	2.649	3.466	2.889	3.442
NH3 Loss					
Surface	0.6834	0.1897	0.2042	0.2439	0.3303
Interflow	0.3971E-01	0.7971E-01	0.7952E-01	0.5358E-01	0.6313E-01
Baseflow	0.5954E-01	0.3052E-01	0.2419E-01	0.1872E-01	0.3324E-01
Sediment	0.6387E-02	0.1699E-02	0.1446E-02	0.7073E-03	0.2560E-02
Total	0.7890	0.3016	0.3093	0.3169	0.4292
ORGN Sediment	1.612	0.4597	0.3873	0.1860	0.6612
Total N Loss (lb/a)	7.163	3.410	4.163	3.392	4.532
PO4 Loss					
Surface	1.085	0.3883	0.4430	0.2713	0.5469
Interflow	0.1690	0.2596E-01	0.2827E-01	0.2725E-01	0.6262E-01
Baseflow	0.3624E-02	0.9229E-04	0.8669E-04	0.6506E-04	0.9670E-03
Sediment	0.2610E-01	0.7340E-02	0.6151E-02	0.2948E-02	0.1063E-01
Total	1.284	0.4217	0.4775	0.3016	0.6212
ORGP Sediment	0.4336	0.1243	0.1054	0.5049E-01	0.1784
Total P Loss (lb/a)	1.717	0.5460	0.5829	0.3521	0.7995
Atm Depn. NO3 (lb/a)	7.739	6.932	6.840	6.777	7.072
Atm Depn. NH4 (lb/a)	2.434	1.971	1.875	1.871	2.038
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	7.380	7.380	7.380	7.380	7.380
Nitrate appln.(lb/a)	0.3900	0.3900	0.3900	0.3900	0.3900
ORGN appln.(lb/a)	8.160	8.160	8.160	8.160	8.160
Total N appln.(lb/a)	15.93	15.93	15.93	15.93	15.93
PO4-p appln.(lb/a)	13.87	13.87	13.87	13.87	13.87
ORGP appln.(lb/a)	2.160	2.160	2.160	2.160	2.160
Total P appln.(lb/a)	16.03	16.03	16.03	16.03	16.03
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.8000E-02	0.4000E-02	0.3000E-02	0.4000E-02	0.4750E-02
Upper	12.03	12.28	12.16	13.24	12.43
Lower	12.19	12.58	12.58	12.58	12.48
Total	24.22	24.86	24.74	25.82	24.91
Phosphorus					
Surface	0.1800E-01	0.9000E-02	0.7000E-02	0.1100E-01	0.1125E-01
Upper	13.90	13.06	11.68	12.57	12.80
Lower	2.002	2.001	2.001	2.001	2.001
Total	15.91	15.07	13.69	14.58	14.81
Deficit (lb/a)					
Nitrogen					
Surface	0.3926	0.3963	0.3972	0.3959	0.3955
Upper	15.11	14.86	14.98	13.89	14.71
Lower	0.3947	0.0000	0.0000	0.0000	0.9867E-01
Total	15.89	15.25	15.38	14.29	15.20
Phosphorus					
Surface	0.9828	0.9918	0.9938	0.9898	0.9895
Upper	3.121	3.955	5.328	4.439	4.211
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	4.103	4.947	6.321	5.429	5.200
Other Fluxes-lb/ac					
N Mineralization	16.39	17.20	17.17	17.30	17.02
P Mineralization	3.016	2.779	2.525	2.560	2.720
Denitrification	0.6809	0.9829	1.385	1.418	1.117
N Immobilization	2.662	3.308	3.299	3.231	3.125
P Immobilization	3.515	1.977	2.598	1.949	2.510

AGCHEM RESULTS FOR MONOCACY (HAY), SEGMENT 756

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	33.14	43.14	47.51	35.54	39.83
Runoff (in)					
Surface	2.967	7.344	7.562	3.891	5.441
Interflow	1.955	3.344	3.640	2.106	2.761
Baseflow	3.684	5.834	5.528	4.190	4.809
Total	8.607	16.52	16.73	10.19	13.01
Sediment Loss (t/a)	0.8551E-01	0.2860	0.3280	0.2490	0.2371
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.1838	0.3141	0.2416	0.1633	0.2257
Interflow	0.3382	0.3214	0.5300	0.3375	0.3818
Baseflow	2.291	3.303	2.625	1.995	2.553
Total	2.813	3.938	3.396	2.496	3.161
NH3 Loss					
Surface	0.1614	0.5172	0.2369	0.1852	0.2752
Interflow	0.5855E-01	0.7081E-01	0.6651E-01	0.5199E-01	0.6197E-01
Baseflow	0.1369E-01	0.1924E-01	0.1607E-01	0.1119E-01	0.1505E-01
Sediment	0.8662E-03	0.3068E-02	0.3450E-02	0.2674E-02	0.2515E-02
Total	0.2345	0.6103	0.3229	0.2511	0.3547
ORGN Sediment	0.2211	0.7726	0.9073	0.6968	0.6495
Total N Loss (lb/a)	3.268	5.321	4.626	3.444	4.165
PO4 Loss					
Surface	0.1728	1.165	0.3271	0.3393	0.5010
Interflow	0.1155E-01	0.3861E-01	0.3430E-01	0.2094E-01	0.2635E-01
Baseflow	0.4727E-04	0.7058E-04	0.5712E-04	0.3166E-04	0.5166E-04
Sediment	0.3547E-02	0.1390E-01	0.1394E-01	0.1131E-01	0.1067E-01
Total	0.1880	1.217	0.3754	0.3716	0.5380
ORGP Sediment	0.5919E-01	0.2082	0.2479	0.1921	0.1768
Total P Loss (lb/a)	0.2472	1.426	0.6233	0.5637	0.7150
Atm Depn. NO3 (lb/a)	6.527	7.305	7.390	6.621	6.961
Atm Depn. NH4 (lb/a)	1.767	2.315	2.235	1.752	2.017
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	7.380	7.380	7.380	7.370	7.378
Nitrate appln.(lb/a)	0.3900	0.3900	0.3900	0.3860	0.3890
ORGN appln.(lb/a)	8.160	8.160	8.160	8.160	8.160
Total N appln.(lb/a)	15.93	15.93	15.93	15.92	15.93
PO4-p appln.(lb/a)	13.87	13.87	13.87	13.77	13.84
ORGP appln.(lb/a)	2.160	2.160	2.160	2.160	2.160
Total P appln.(lb/a)	16.03	16.03	16.03	15.93	16.00
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.4000E-02	0.1000E-01	0.5000E-02	0.3000E-02	0.5500E-02
Upper	12.87	14.02	13.90	12.43	13.30
Lower	12.58	12.58	12.58	12.58	12.58
Total	25.46	26.60	26.48	25.01	25.89
Phosphorus					
Surface	0.8000E-02	0.2100E-01	0.1000E-01	0.7000E-02	0.1150E-01
Upper	12.66	12.15	12.19	11.06	12.01
Lower	2.002	2.001	2.001	2.001	2.001
Total	14.67	14.17	14.20	13.06	14.03
Deficit (lb/a)					
Nitrogen					
Surface	0.3966	0.3907	0.3954	0.3973	0.3950
Upper	14.26	13.12	13.24	14.71	13.83
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	14.66	13.51	13.64	15.11	14.23
Phosphorus					
Surface	0.9927	0.9795	0.9902	0.9931	0.9889
Upper	4.353	4.864	4.819	5.953	4.997
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	5.346	5.843	5.809	6.946	5.986
Other Fluxes-lb/ac					
N Mineralization	17.89	17.44	17.52	17.30	17.54
P Mineralization	2.566	2.658	2.679	2.444	2.587
Denitrification	1.493	1.399	1.268	1.356	1.379
N Immobilization	3.489	3.369	3.443	3.354	3.414
P Immobilization	1.940	1.914	2.546	3.001	2.350



SIMULATED AND OBSERVED FLOW AT REACH 210
MONOCACY RIVER AT JUG BRIDGE NEAR FREDERICK, MD



FREQUENCY ANALYSIS OF FLOW AT REACH 210
MONOCACY RIVER AT JUG BRIDGE NEAR FREDERICK, MD

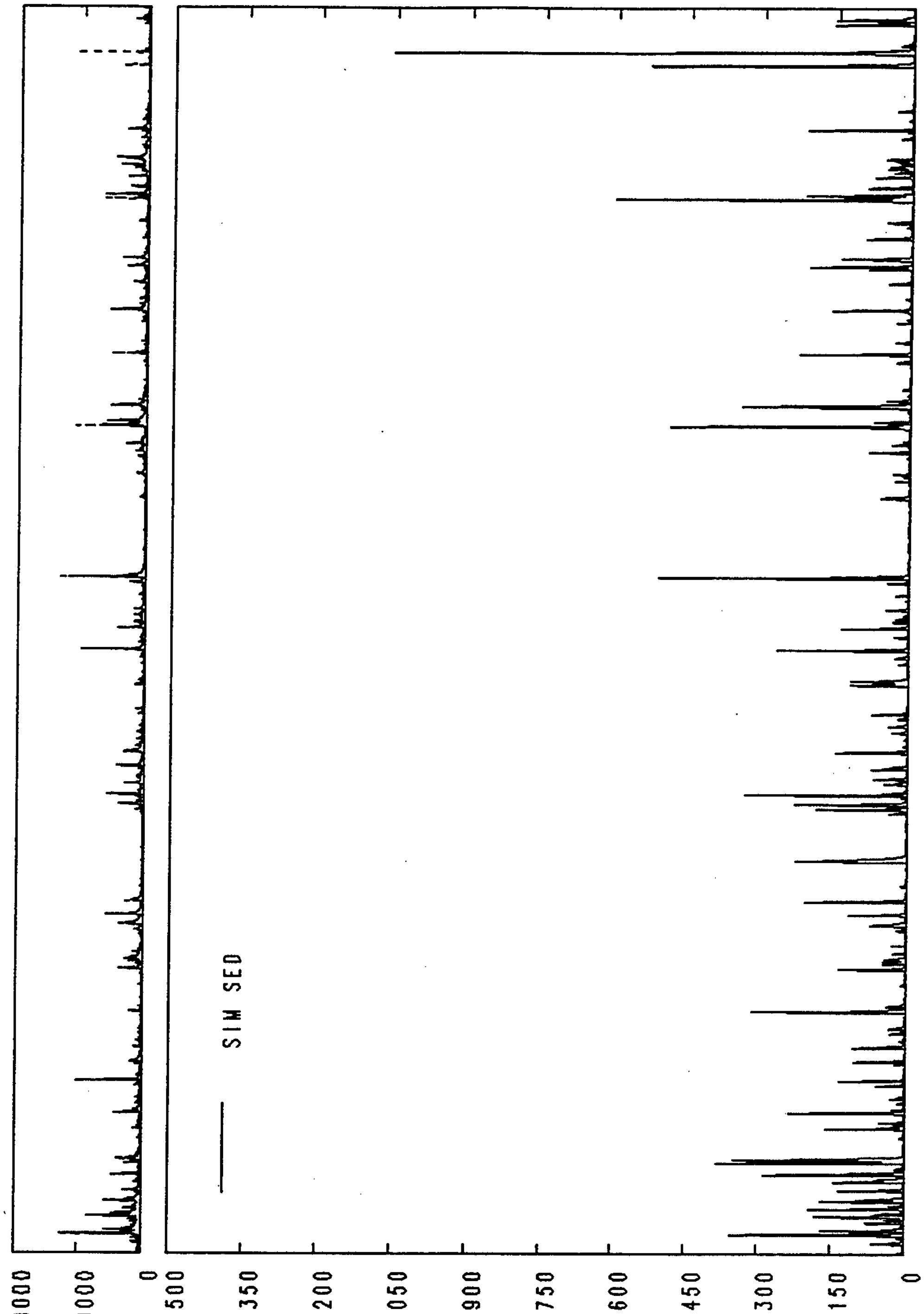
CHESAPEAKE BAY WATERSHED HYDROLOGIC CALIBRATION
COMPARISON OF ANNUAL TOTAL OBSERVED vs SIMULATED FLOW

PHASE III

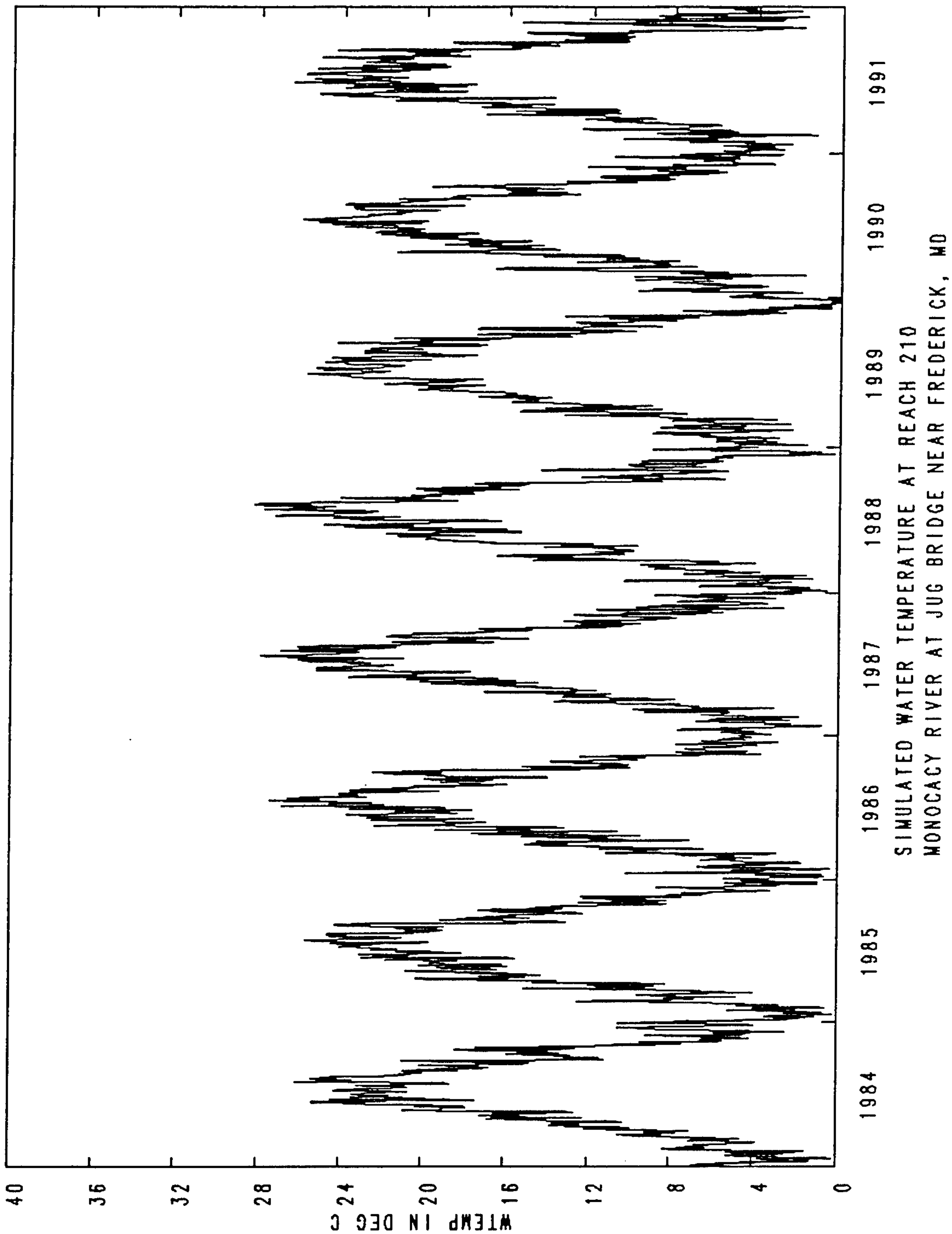
MONOCACY RIVER AT BRIDGEPORT, MD (SEGMENT 210)

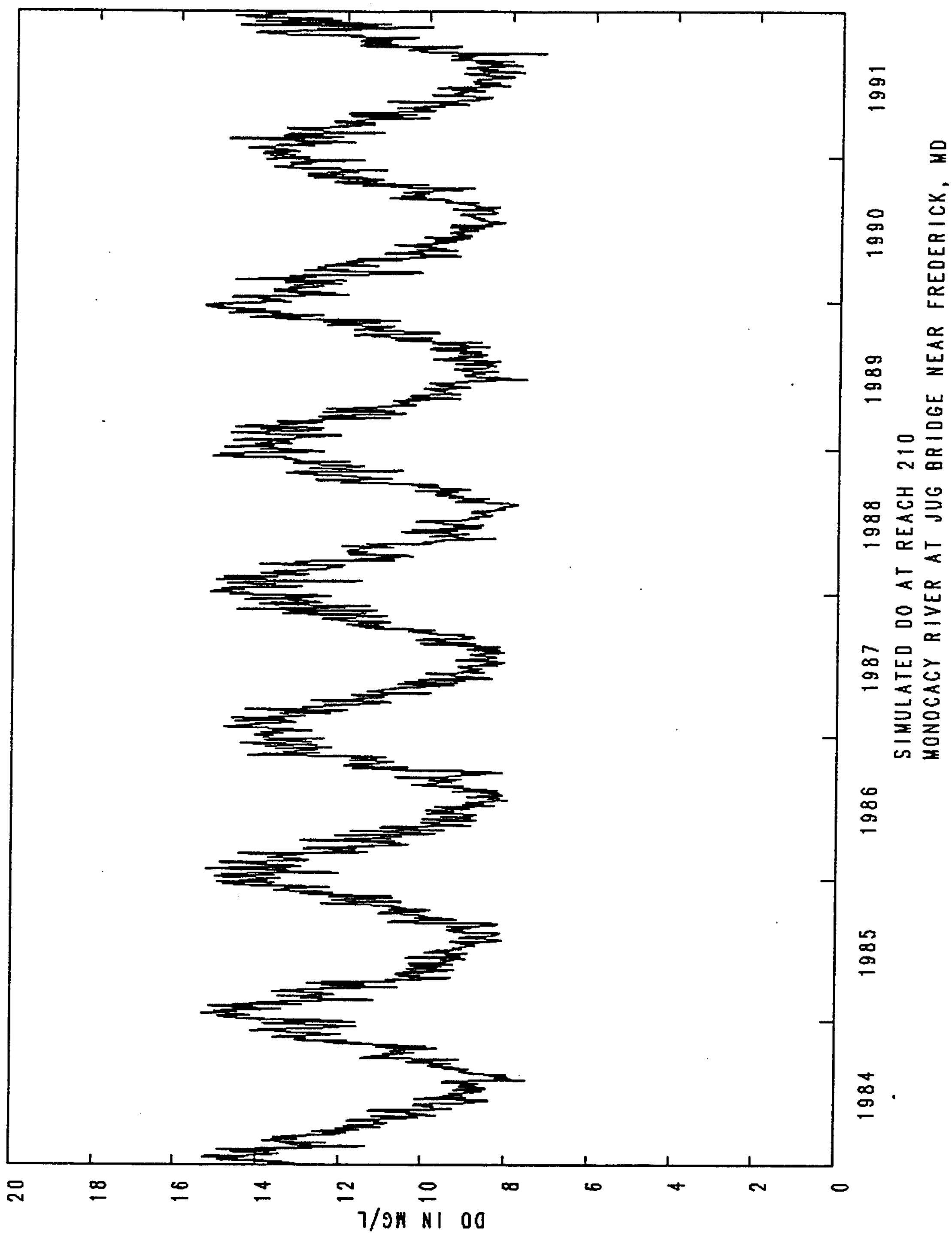
YEAR	OBSERVED* FLOW (in)	SIMULATED** FLOW (in)
1984	25.40	24.50
1985	11.96	12.30
1986	11.58	11.54
1987	14.26	12.09
1988	11.51	11.59
1989	16.50	16.59
1990	16.56	15.81
1991	11.77	12.06
MEAN	14.94	14.56

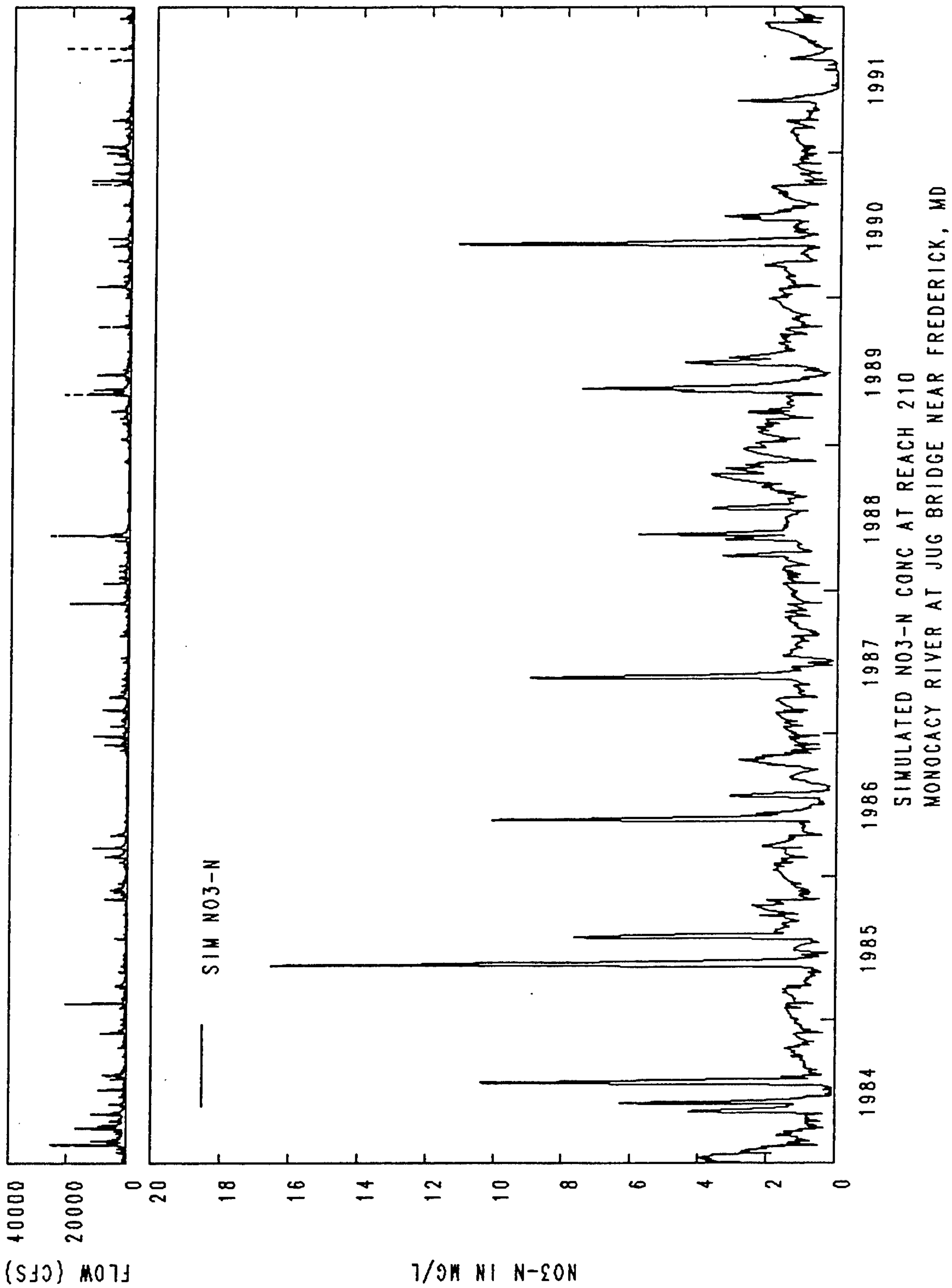
* - Observed Flow at Monocacy River at Jug Bridge near Frederick, MD
** - Simulated Outflow from RCH 210

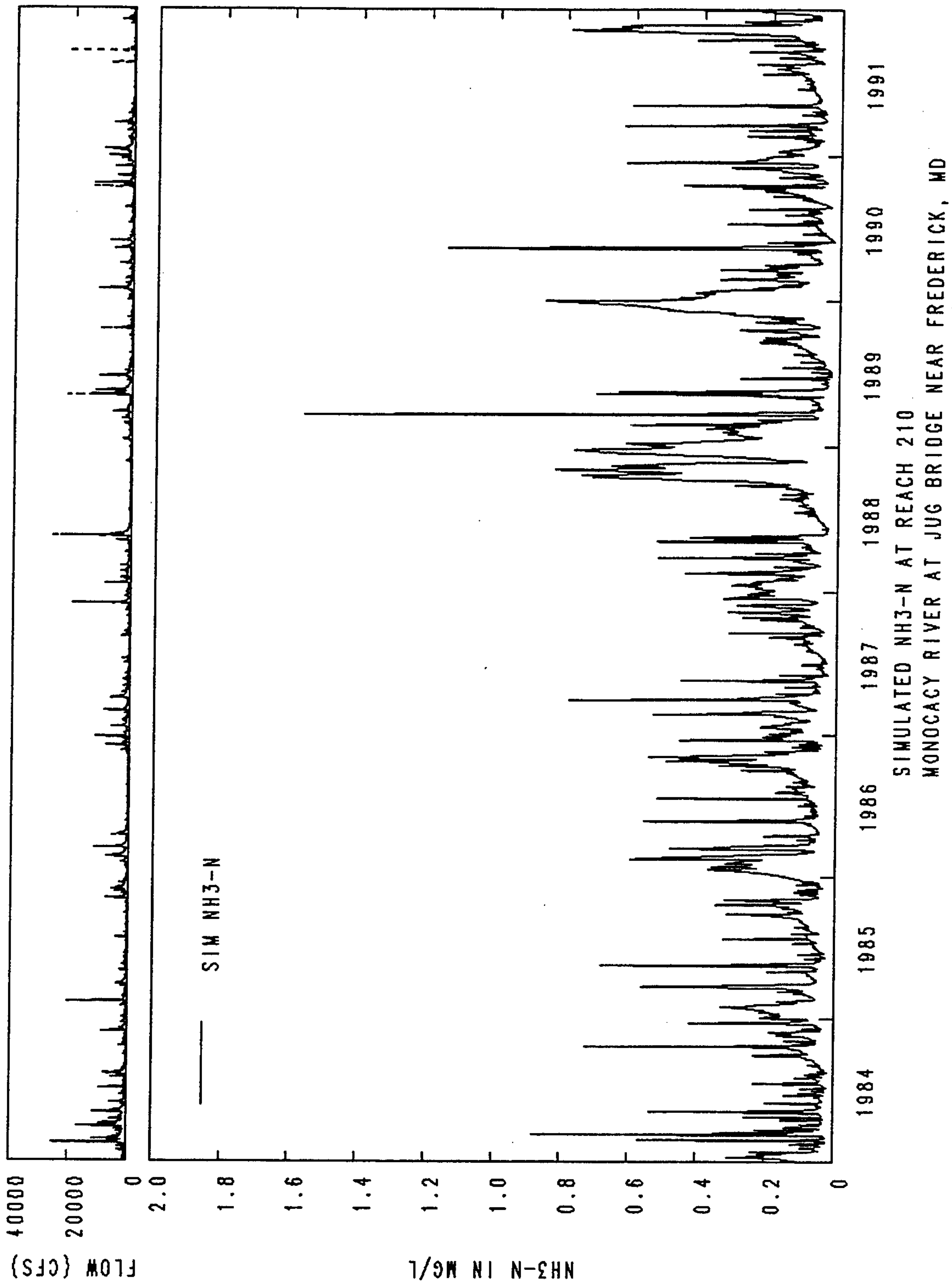


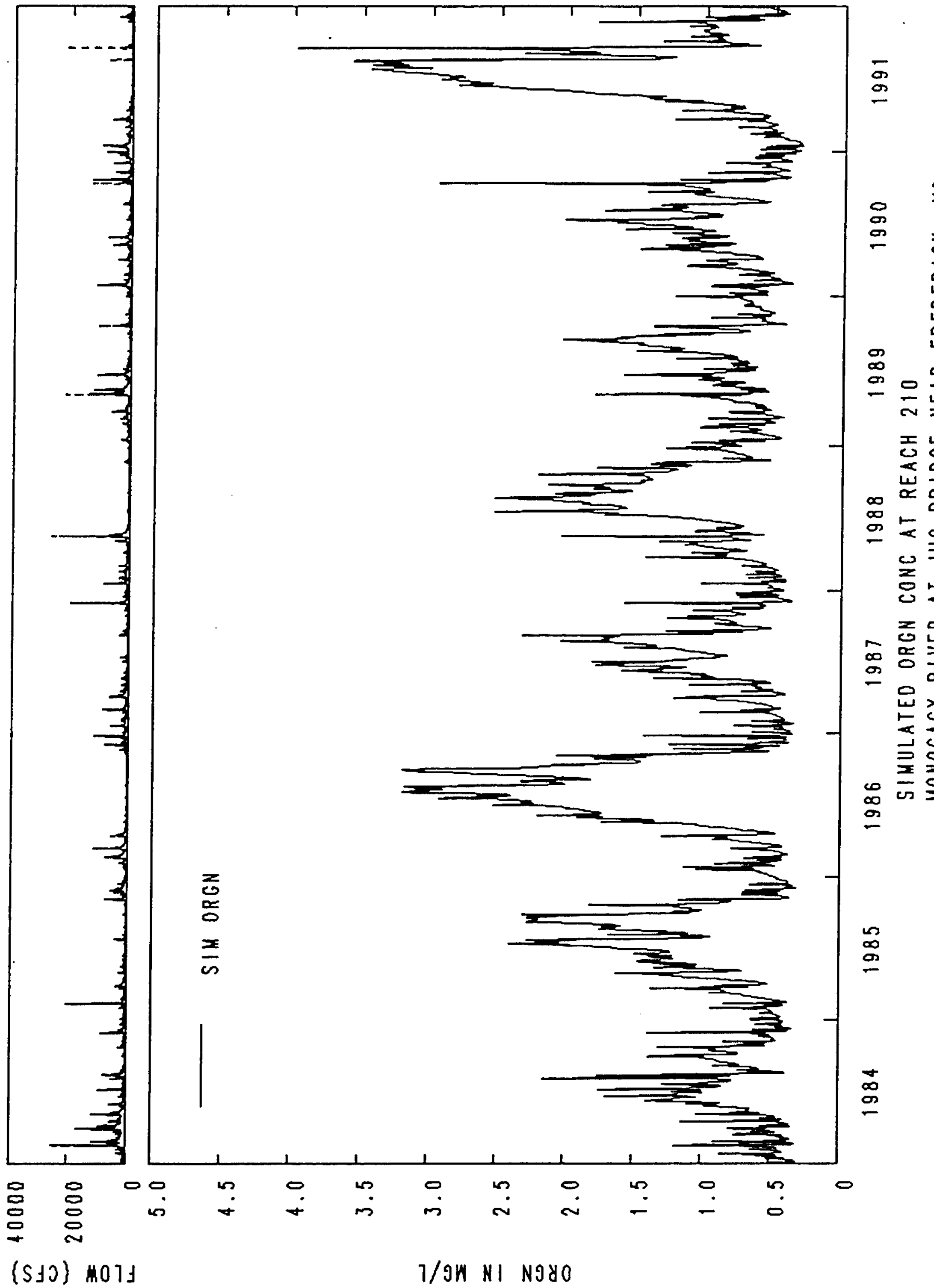
SIMULATED SEDIMENT CONC AT REACH 210
MONOCACY RIVER AT JUG BRIDGE NEAR FREDERICK, MD

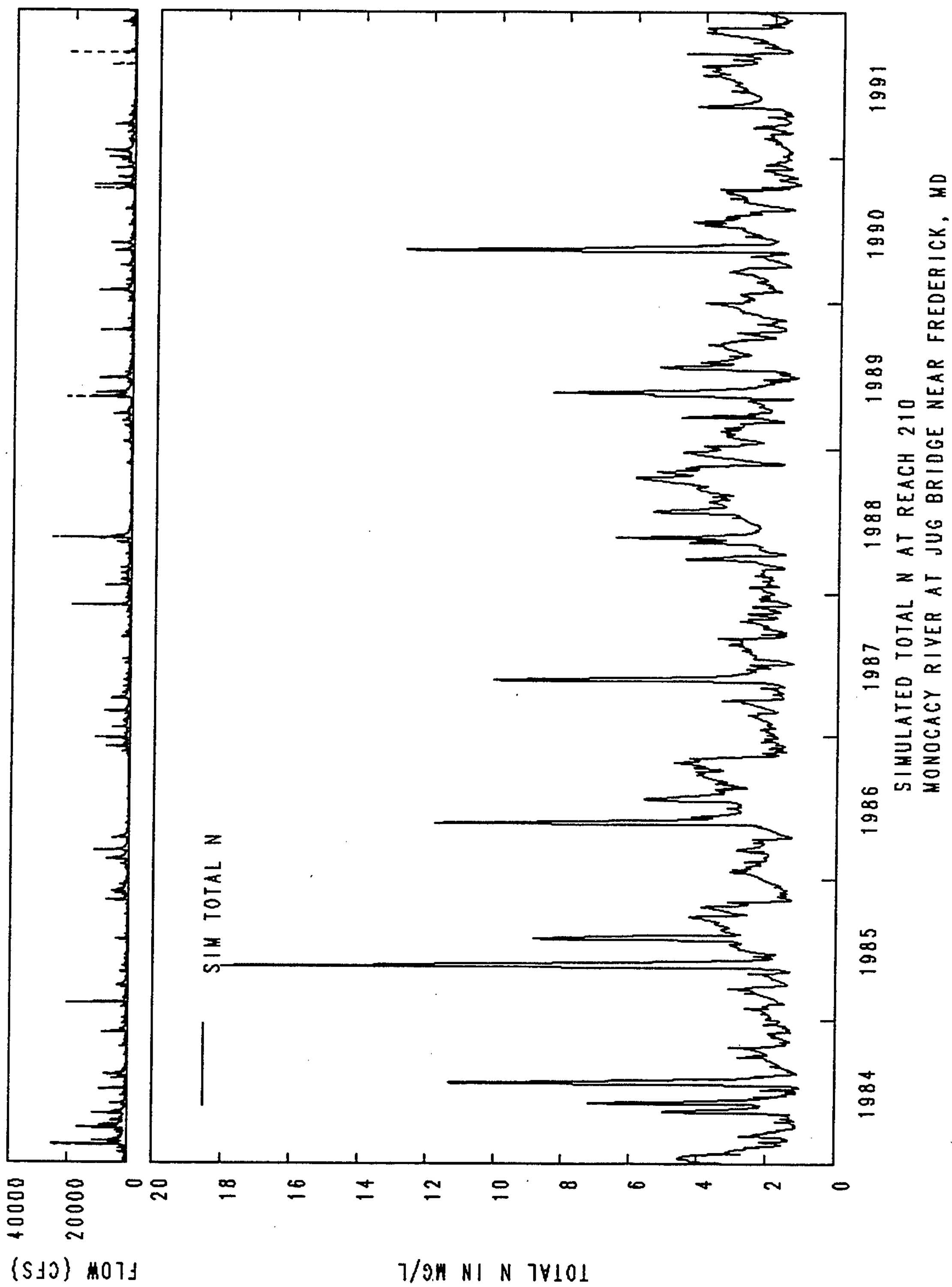

SIMULATED WATER TEMPERATURE AT REACH 210
MONOCACY RIVER AT JUG BRIDGE NEAR FREDERICK, MD
WTEMP IN DEG C
0
4
8
12
16
20
24
28
32
36
40
1984
1985
1986
1987
1988
1989
1990
1991

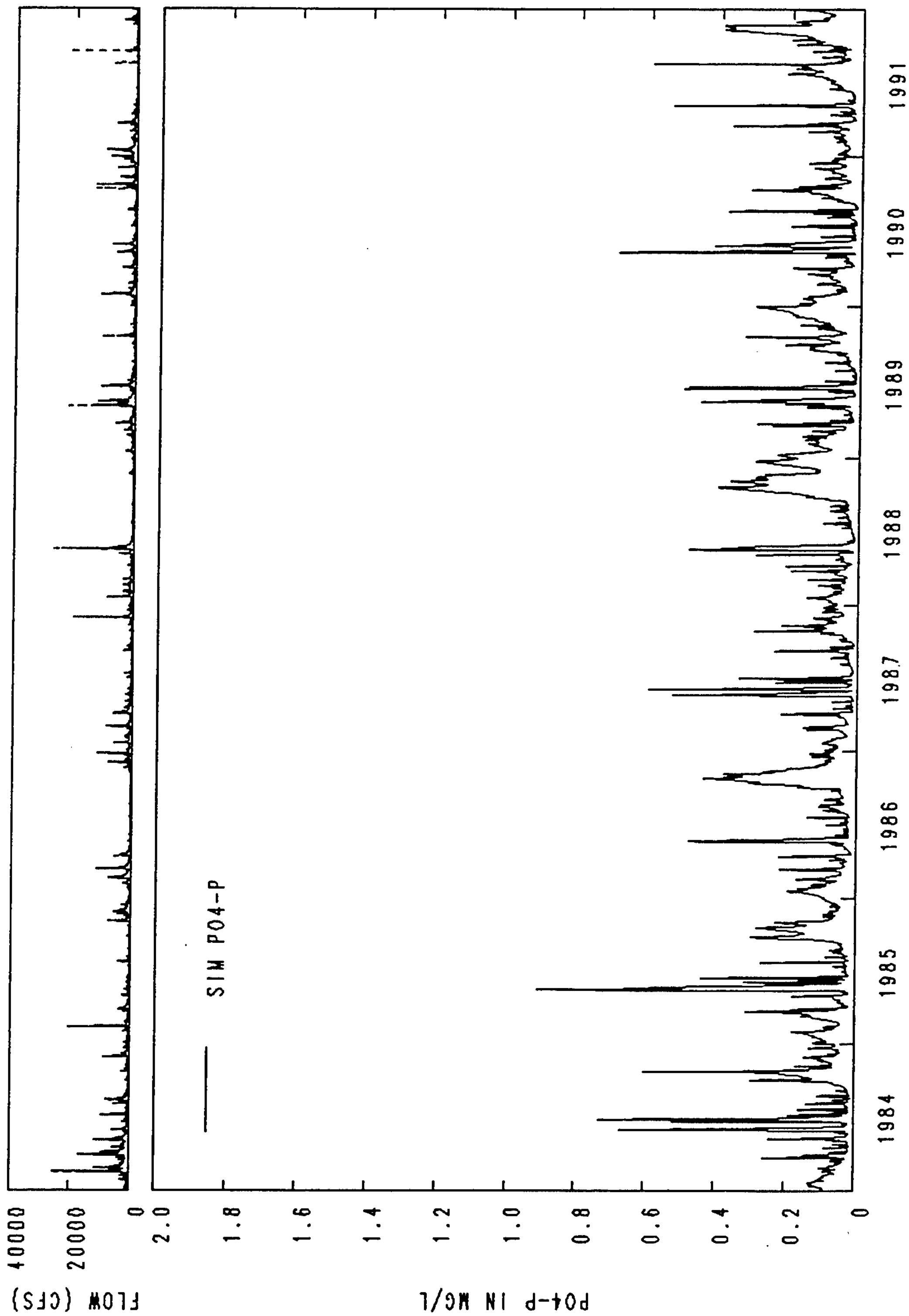

SIMULATED DO AT REACH 210
MONOCACY RIVER AT JUG BRIDGE NEAR FREDERICK, MD
DO IN MG/L
0
2
4
6
8
10
12
14
16
18
20
1984
1985
1986
1987
1988
1989
1990
1991


FLOW (CFS)
40000
20000
0
NO3-N IN MG/L
20
18
16
14
12
10
8
6
4
2
0
SIM NO3-N
1984
1985
1986
1987
1988
1989
1990
1991
SIMULATED NO3-N CONC AT REACH 210
MONOCACY RIVER AT JUG BRIDGE NEAR FREDERICK, MD

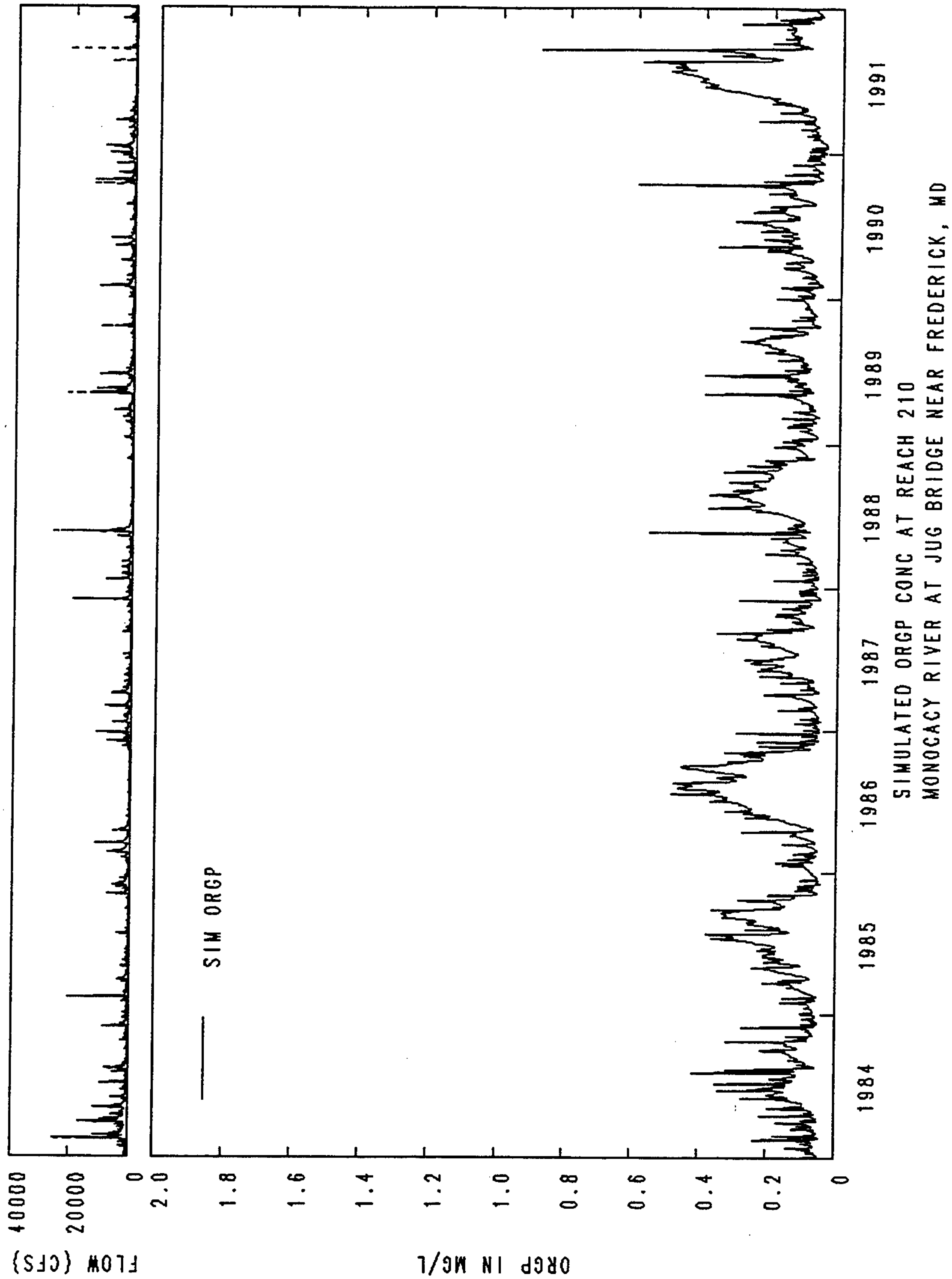

SIMULATED NH3-N AT REACH 210
MONOCACY RIVER AT JUG BRIDGE NEAR FREDERICK, MD
SIM NH3-N
FLOW (CFS)
NH3-N IN MG/L
40000
20000
0
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
1984
1985
1986
1987
1988
1989
1990
1991

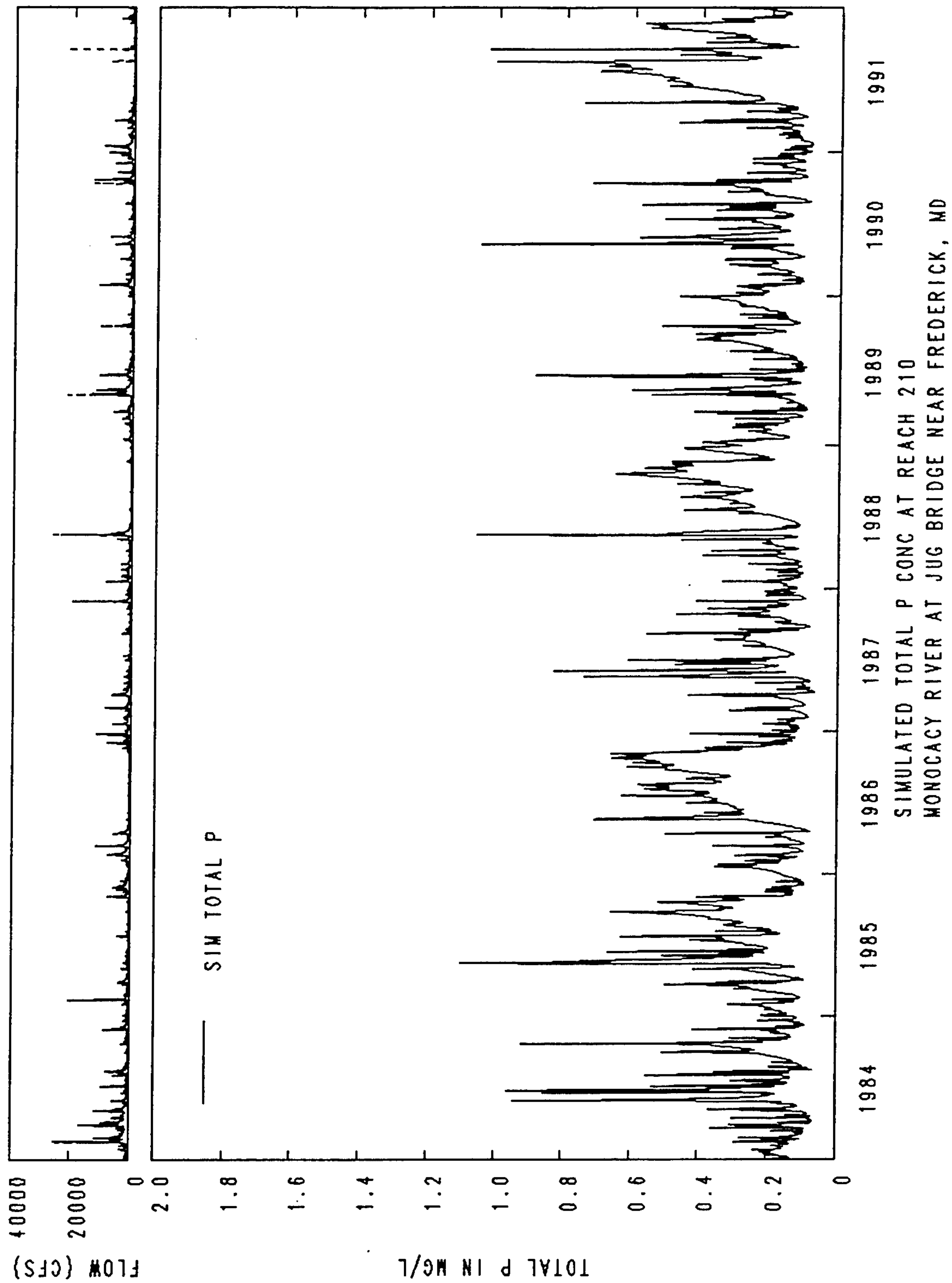

SIMULATED ORGN CONC AT REACH 210
MONOCACY RIVER AT JUG BRIDGE NEAR FREDERICK, MD
SIM ORGN
FLOW (CFS)
40000
20000
0
ORGN IN MG/L
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
1984
1985
1986
1987
1988
1989
1990
1991

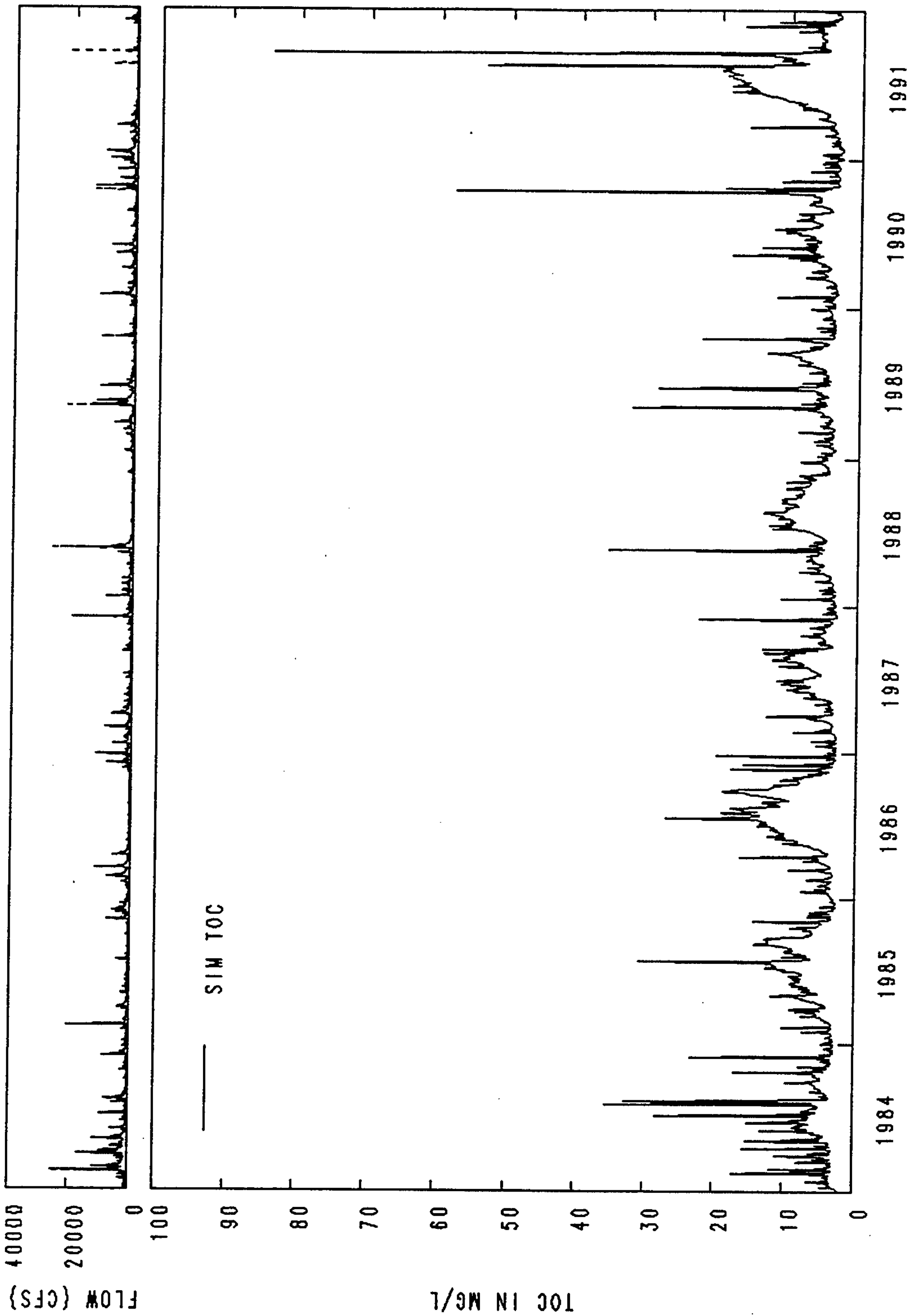

FLOW (CFS)
40000
20000
0
TOTAL N IN MG/L
20
18
16
14
12
10
8
6
4
2
0
SIM TOTAL N
1984
1985
1986
1987
1988
1989
1990
1991
SIMULATED TOTAL N AT REACH 210
MONOCACY RIVER AT JUG BRIDGE NEAR FREDERICK, MD



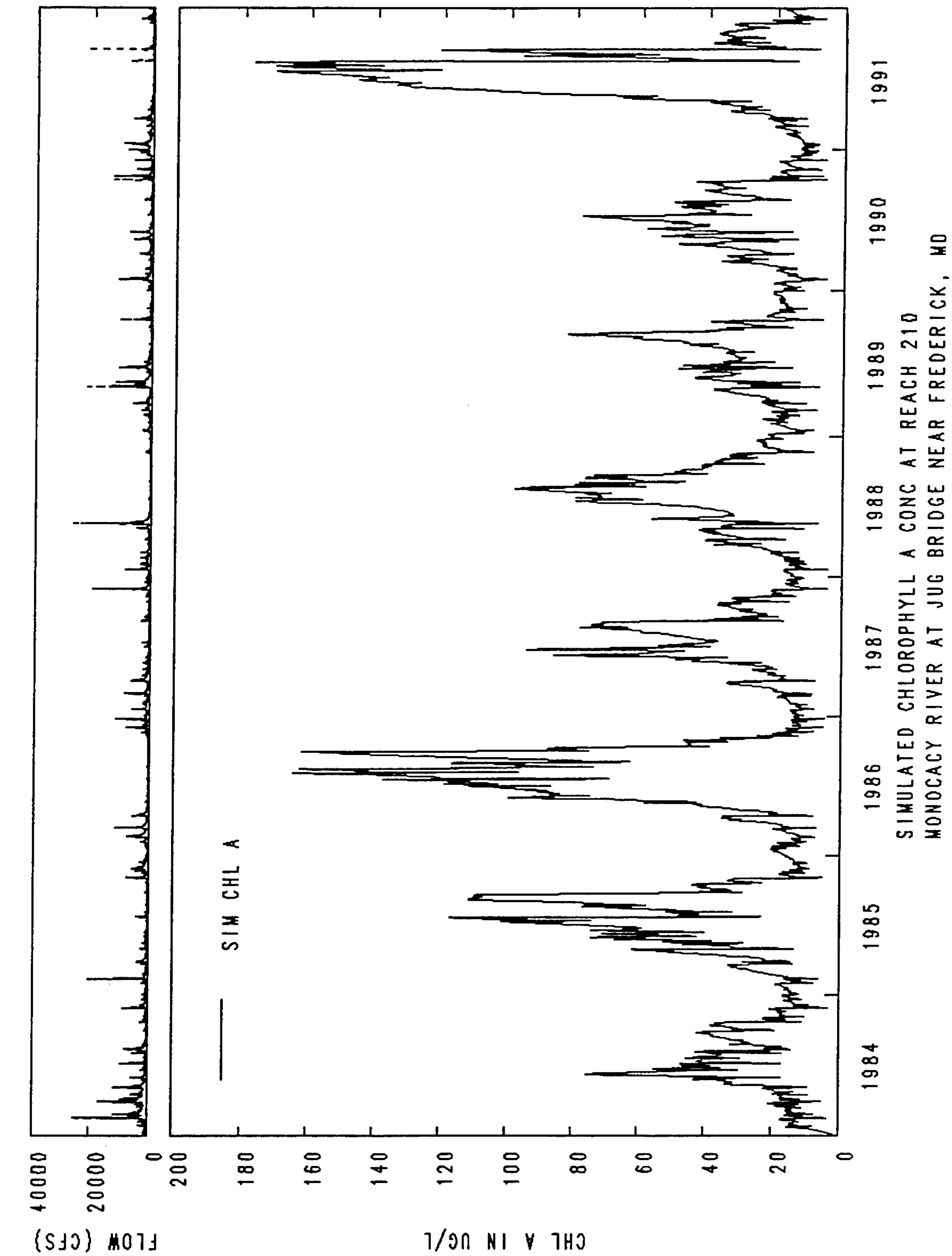
SIMULATED PO4-P CONC AT REACH 210
MONOCACY RIVER AT JUG BRIDGE NEAR FREDERICK, MD


FLOW (CFS)
40000
20000
0
ORGP IN MG/L
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
SIM ORGP
1984
1985
1986
1987
1988
1989
1990
1991
SIMULATED ORGP CONC AT REACH 210
MONOCACY RIVER AT JUG BRIDGE NEAR FREDERICK, MD

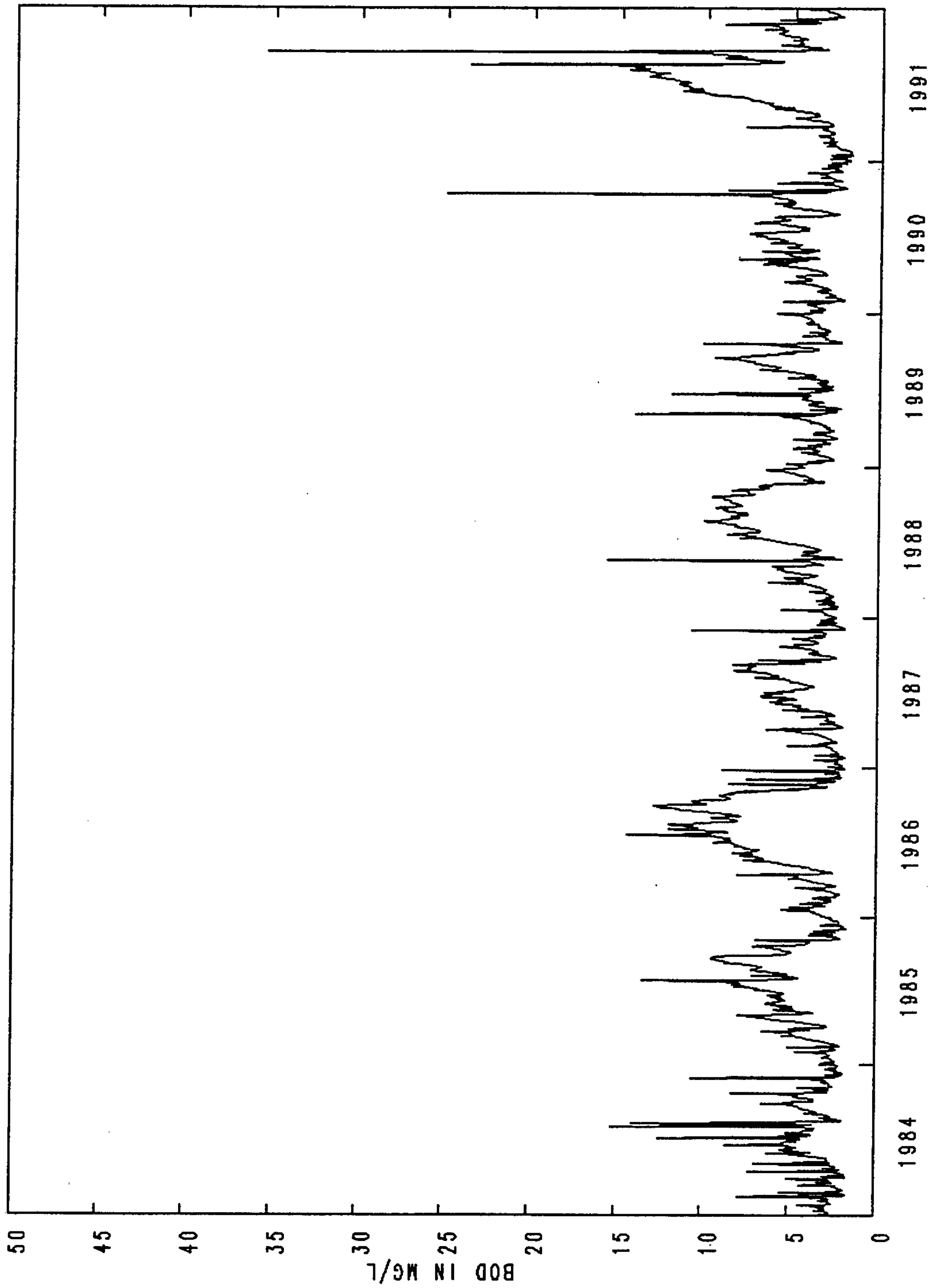

SIMULATED TOTAL P CONC AT REACH 210
MONOCACY RIVER AT JUG BRIDGE NEAR FREDERICK, MD
SIM TOTAL P
FLOW (CFS)
40000
20000
0
TOTAL P IN MG/L
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
1984
1985
1986
1987
1988
1989
1990
1991



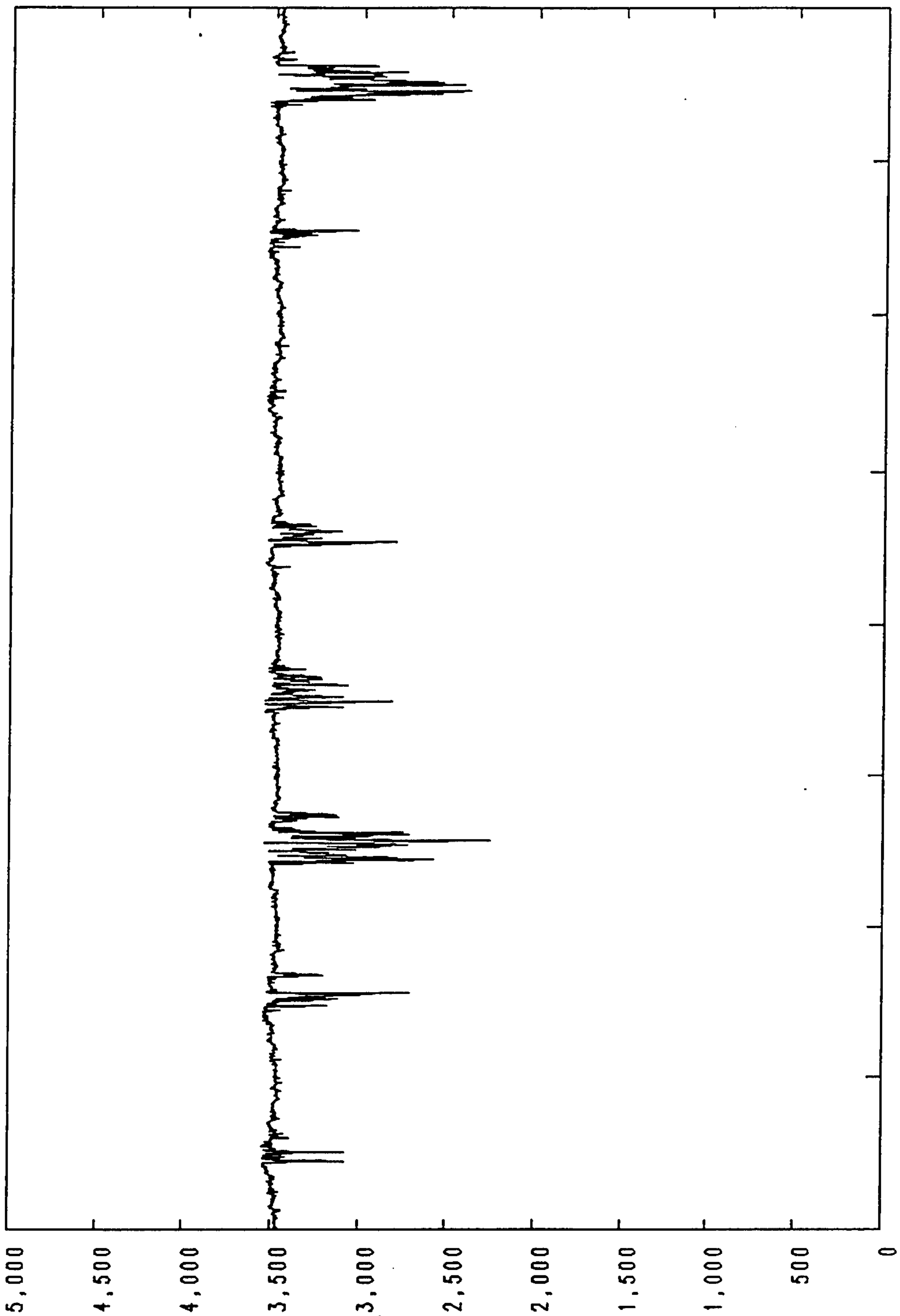
SIMULATED TOC AT REACH 210
MONOCACY RIVER AT JUG BRIDGE NEAR FREDERICK, MD



FLOW (CFS)
40000
20000
0
CHL A IN UG/L
200
180
160
140
120
100
80
60
40
20
0
SIM CHL A
1984
1985
1986
1987
1988
1989
1990
1991
SIMULATED CHLOROPHYLL A CONC AT REACH 210
MONOCACY RIVER AT JUG BRIDGE NEAR FREDERICK, MD



SIMULATED BOD AT REACH 210
MONOCACY RIVER AT JUG BRIDGE NEAR FREDERICK, MD



SIMULATED BENTHIC ALGAE AT REACH 210
MONOCACY RIVER AT JUG BRIDGE NEAR FREDERICK, MD

AGCHEM RESULTS FOR MONOCACY (HI-TILL), SEGMENT 212

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	47.38	37.01	35.51	38.42	39.58
Runoff (in)					
Surface	9.686	3.100	3.673	3.749	5.052
Interflow	7.846	4.593	4.071	4.385	5.224
Baseflow	8.070	5.202	4.463	5.505	5.810
Total	25.60	12.90	12.21	13.64	16.09
Sediment Loss (t/a)	0.5910	0.1110	0.2310	0.2000	0.2833
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.7421	0.1587	0.1585	0.1851	0.3111
Interflow	7.737	6.882	3.423	3.018	5.265
Baseflow	2.391	2.253	2.953	3.927	2.881
Total	10.87	9.294	6.535	7.130	8.457
NH3 Loss					
Surface	1.533	0.2801	0.4027	0.4231	0.6597
Interflow	0.9724	1.258	1.437	1.229	1.224
Baseflow	0.4781E-01	0.1504E-01	0.9153E-02	0.8663E-02	0.2017E-01
Sediment	0.6726E-02	0.1103E-02	0.2394E-02	0.2126E-02	0.3087E-02
Total	2.560	1.554	1.851	1.663	1.907
ORGN Sediment	1.917	0.3386	0.7584	0.6509	0.9162
Total N Loss (lb/a)	15.35	11.19	9.145	9.444	11.28
PO4 Loss					
Surface	0.7139	0.2715	0.2482	0.2977	0.3828
Interflow	0.5020	0.5438	0.4460	0.4509	0.4857
Baseflow	0.1237E-02	0.3198E-04	0.2970E-04	0.3326E-04	0.3330E-03
Sediment	0.2498E-01	0.4495E-02	0.9878E-02	0.8672E-02	0.1201E-01
Total	1.242	0.8199	0.7040	0.7574	0.8808
ORGP Sediment	0.5309	0.9394E-01	0.2102	0.1802	0.2538
Total P Loss (lb/a)	1.773	0.9138	0.9142	0.9376	1.135
Atm Depn. NO3 (lb/a)	7.537	6.682	6.514	6.913	6.911
Atm Depn. NH4 (lb/a)	2.396	1.904	1.691	2.022	2.003
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	83.22	84.26	84.42	84.42	84.08
Nitrate appln.(lb/a)	23.95	24.30	24.35	24.35	24.24
ORGN appln.(lb/a)	14.82	14.82	14.82	14.82	14.82
Total N appln.(lb/a)	122.0	123.4	123.6	123.6	123.1
PO4-p appln.(lb/a)	30.50	30.17	30.50	30.50	30.42
ORGP appln.(lb/a)	3.720	3.720	3.720	3.720	3.720
Total P appln.(lb/a)	34.22	33.89	34.22	34.22	34.14
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.2100E-01	0.1100E-01	0.4000E-02	0.1700E-01	0.1325E-01
Upper	65.29	56.20	57.98	71.63	62.78
Lower	28.77	44.03	44.02	44.03	40.21
Total	94.08	100.2	102.0	115.7	103.0
Phosphorus					
Surface	0.2200E-01	0.1200E-01	0.5000E-02	0.1800E-01	0.1425E-01
Upper	21.69	21.46	23.72	22.19	22.27
Lower	2.802	2.801	2.801	2.801	2.801
Total	24.52	24.28	26.53	25.01	25.08
Deficit (lb/a)					
Nitrogen					
Surface	1.380	1.390	1.396	1.384	1.387
Upper	29.69	38.79	37.00	23.35	32.21
Lower	15.36	0.0000	0.0000	0.0000	3.840
Total	46.43	40.18	38.40	24.74	37.44
Phosphorus					
Surface	1.379	1.389	1.396	1.382	1.387
Upper	2.147	2.362	0.1285	1.624	1.565
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	3.526	3.751	1.525	3.006	2.952
Other Fluxes-lb/ac					
N Mineralization	10.45	17.15	19.74	19.88	16.81
P Mineralization	3.368	3.401	3.285	3.438	3.373
Denitrification	0.6276	2.004	3.536	2.369	2.134
N Immobilization	16.60	18.29	18.15	17.58	17.66
P Immobilization	7.533	8.255	5.686	8.989	7.616

AGCHEM RESULTS FOR MONOCACY (HI-TILL), SEGMENT 212

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	35.70	41.36	45.15	35.53	39.43
Runoff (in)					
Surface	4.893	5.825	5.687	4.738	5.286
Interflow	3.676	5.428	5.655	3.631	4.598
Baseflow	4.348	6.058	5.374	4.539	5.080
Total	12.92	17.31	16.72	12.91	14.96
Sediment Loss (t/a)	0.5320	0.4840	0.3840	0.9400	0.5850
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.2683	0.4020	0.3914	0.2043	0.3165
Interflow	8.733	10.30	6.099	2.604	6.934
Baseflow	2.015	4.485	1.804	0.5469	2.213
Total	11.02	15.18	8.294	3.355	9.462
NH3 Loss					
Surface	0.4221	0.7728	0.6667	0.4652	0.5817
Interflow	1.663	2.051	1.759	0.8355	1.577
Baseflow	0.5575E-02	0.6919E-02	0.5129E-02	0.4007E-02	0.5408E-02
Sediment	0.5748E-02	0.5487E-02	0.4311E-02	0.1110E-01	0.6661E-02
Total	2.097	2.836	2.435	1.316	2.171
ORGN Sediment	1.762	1.594	1.274	3.179	1.952
Total N Loss (lb/a)	14.88	19.61	12.00	7.850	13.59
PO4 Loss					
Surface	0.5766	0.4688	0.6814	0.2543	0.4953
Interflow	0.7700	0.7647	0.6961	0.2672	0.6245
Baseflow	0.2481E-04	0.3924E-04	0.3553E-04	0.2078E-04	0.3009E-04
Sediment	0.2579E-01	0.2196E-01	0.1850E-01	0.4376E-01	0.2750E-01
Total	1.372	1.256	1.396	0.5653	1.147
ORGP Sediment	0.4871	0.4414	0.3527	0.8822	0.5409
Total P Loss (lb/a)	1.860	1.697	1.749	1.447	1.688
Atm Depn. NO3 (lb/a)	6.617	7.267	7.268	6.486	6.910
Atm Depn. NH4 (lb/a)	1.905	2.341	2.248	1.723	2.054
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	82.09	84.28	82.41	83.05	82.96
Nitrate appln.(lb/a)	23.57	24.30	23.68	23.89	23.86
ORGN appln.(lb/a)	14.82	14.82	14.82	14.82	14.82
Total N appln.(lb/a)	120.5	123.4	120.9	121.8	121.6
PO4-p appln.(lb/a)	29.84	30.22	29.42	30.04	29.88
ORGP appln.(lb/a)	3.720	3.720	3.720	3.720	3.720
Total P appln.(lb/a)	33.56	33.94	33.14	33.76	33.60
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.1600E-01	0.1700E-01	0.9000E-02	0.6000E-02	0.1200E-01
Upper	48.79	59.44	62.52	65.67	59.10
Lower	44.05	44.03	39.89	41.06	42.26
Total	92.85	103.5	102.4	106.7	101.4
Phosphorus					
Surface	0.1700E-01	0.1600E-01	0.1000E-01	0.6000E-02	0.1225E-01
Upper	22.13	21.25	22.05	23.72	22.29
Lower	2.802	2.801	2.801	2.801	2.801
Total	24.95	24.07	24.86	26.52	25.10
Deficit (lb/a)					
Nitrogen					
Surface	1.385	1.384	1.391	1.395	1.389
Upper	46.19	35.54	32.47	29.34	35.88
Lower	0.0000	0.0000	4.132	2.986	1.780
Total	47.57	36.93	37.99	33.72	39.05
Phosphorus					
Surface	1.384	1.384	1.391	1.395	1.388
Upper	1.697	2.563	1.781	0.9997E-01	1.535
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	3.081	3.947	3.172	1.495	2.924
Other Fluxes-lb/ac					
N Mineralization	18.10	18.60	15.03	14.31	16.51
P Mineralization	3.347	3.475	3.410	3.260	3.373
Denitrification	2.785	2.887	1.286	0.5474	1.876
N Immobilization	17.92	17.75	17.40	17.19	17.57
P Immobilization	6.632	9.357	7.631	4.804	7.106

AGCHEM RESULTS FOR MONOCACY (LOW-TILL), SEGMENT 213

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	47.38	37.01	35.51	38.42	39.58
Runoff (in)					
Surface	7.760	2.118	2.775	2.464	3.779
Interflow	7.917	4.355	3.929	4.191	5.098
Baseflow	8.717	5.611	4.764	5.983	6.269
Total	24.39	12.08	11.47	12.64	15.15
Sediment Loss (t/a)	0.2700	0.4788E-01	0.1020	0.7806E-01	0.1245
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.6188	0.1105	0.1102	0.1110	0.2376
Interflow	8.772	8.400	1.976	2.195	5.336
Baseflow	2.496	2.317	1.099	0.6840	1.649
Total	11.89	10.83	3.185	2.990	7.224
NH3 Loss					
Surface	1.420	0.1970	0.3940	0.2834	0.5736
Interflow	0.8590	0.8940	1.161	0.9423	0.9641
Baseflow	0.4987E-01	0.1469E-01	0.8601E-02	0.8459E-02	0.2041E-01
Sediment	0.3069E-02	0.4464E-03	0.1027E-02	0.7761E-03	0.1330E-02
Total	2.332	1.106	1.565	1.235	1.560
ORGN Sediment	1.095	0.1713	0.4060	0.3094	0.4954
Total N Loss (lb/a)	15.31	12.11	5.156	4.535	9.278
PO4 Loss					
Surface	0.7662	0.2581	0.2477	0.2614	0.3833
Interflow	0.4481	0.3292	0.1930	0.2527	0.3057
Baseflow	0.1245E-02	0.3080E-04	0.2447E-04	0.2400E-04	0.3311E-03
Sediment	0.1142E-01	0.1827E-02	0.4295E-02	0.3228E-02	0.5192E-02
Total	1.227	0.5891	0.4451	0.5173	0.6946
ORGP Sediment	0.2911	0.4570E-01	0.1083	0.8237E-01	0.1319
Total P Loss (lb/a)	1.518	0.6348	0.5534	0.5997	0.8265
Atm Depn. NO3 (lb/a)	7.537	6.682	6.514	6.913	6.911
Atm Depn. NH4 (lb/a)	2.396	1.904	1.691	2.022	2.003
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	91.70	92.07	92.32	92.32	92.10
Nitrate appln.(lb/a)	26.86	26.99	27.07	27.07	27.00
ORGN appln.(lb/a)	14.64	14.64	14.64	14.64	14.64
Total N appln.(lb/a)	133.2	133.7	134.0	134.0	133.7
PO4-p appln.(lb/a)	32.08	31.58	32.08	32.08	31.95
ORGP appln.(lb/a)	3.660	3.660	3.660	3.660	3.660
Total P appln.(lb/a)	35.74	35.24	35.74	35.74	35.61
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.3600E-01	0.2100E-01	0.1200E-01	0.2400E-01	0.2325E-01
Upper	71.61	59.43	72.93	84.99	72.24
Lower	30.79	48.80	46.86	31.92	39.59
Total	102.4	108.3	119.8	116.9	111.9
Phosphorus					
Surface	0.3200E-01	0.1800E-01	0.1000E-01	0.2200E-01	0.2050E-01
Upper	22.50	21.15	23.71	22.93	22.57
Lower	2.802	2.801	2.801	2.801	2.801
Total	25.33	23.97	26.52	25.75	25.39
Deficit (lb/a)					
Nitrogen					
Surface	1.515	1.530	1.539	1.527	1.528
Upper	33.54	45.73	32.24	20.17	32.92
Lower	18.04	0.0000	1.910	16.81	9.190
Total	53.10	47.26	35.68	38.51	43.64
Phosphorus					
Surface	1.369	1.383	1.390	1.378	1.380
Upper	1.327	2.665	0.1285	0.8918	1.253
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	2.696	4.048	1.519	2.270	2.633
Other Fluxes-lb/ac					
N Mineralization	10.98	16.98	16.56	13.47	14.50
P Mineralization	3.880	3.516	3.623	3.769	3.697
Denitrification	0.6502	1.998	1.414	0.4859	1.137
N Immobilization	19.09	20.74	20.09	19.75	19.92
P Immobilization	11.89	10.79	7.588	12.05	10.58

AGCHEM RESULTS FOR MONOCACY (LOW-TILL), SEGMENT 213

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	35.70	41.36	45.15	35.53	39.43
Runoff (in)					
Surface	4.152	4.646	4.345	3.759	4.226
Interflow	3.498	5.297	5.486	3.453	4.434
Baseflow	4.698	6.483	5.812	4.842	5.459
Total	12.35	16.43	15.64	12.05	14.12
Sediment Loss (t/a)	0.2570	0.2310	0.1540	0.4330	0.2688
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.2177	0.3751	0.3781	0.1506	0.2804
Interflow	10.36	11.40	7.193	1.294	7.562
Baseflow	2.156	3.192	1.562	0.4333	1.836
Total	12.73	14.97	9.133	1.878	9.678
NH3 Loss					
Surface	0.4520	0.8162	0.7370	0.4094	0.6037
Interflow	1.436	1.752	1.605	0.6684	1.365
Baseflow	0.5537E-02	0.6641E-02	0.4890E-02	0.3894E-02	0.5240E-02
Sediment	0.2793E-02	0.2694E-02	0.1675E-02	0.4945E-02	0.3027E-02
Total	1.897	2.578	2.349	1.087	1.978
ORGN Sediment	1.061	0.9401	0.6174	1.817	1.109
Total N Loss (lb/a)	15.69	18.49	12.10	4.782	12.77
PO4 Loss					
Surface	0.7974	0.6777	0.8152	0.2829	0.6433
Interflow	0.7813	0.6334	0.4565	0.1322	0.5009
Baseflow	0.1599E-04	0.2166E-04	0.1639E-04	0.7540E-05	0.1539E-04
Sediment	0.1311E-01	0.1077E-01	0.7354E-02	0.1983E-01	0.1277E-01
Total	1.592	1.322	1.279	0.4350	1.157
ORGP Sediment	0.2827	0.2502	0.1647	0.4859	0.2959
Total P Loss (lb/a)	1.875	1.572	1.444	0.9209	1.453
Atm Depn. NO3 (lb/a)	6.617	7.267	7.268	6.486	6.910
Atm Depn. NH4 (lb/a)	1.905	2.341	2.248	1.723	2.054
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	89.39	92.11	89.89	91.01	90.60
Nitrate appln.(lb/a)	26.10	27.00	26.26	26.63	26.50
ORGN appln.(lb/a)	14.64	14.64	14.64	14.64	14.64
Total N appln.(lb/a)	130.1	133.7	130.8	132.3	131.7
PO4-p appln.(lb/a)	31.07	31.65	30.77	31.52	31.25
ORGP appln.(lb/a)	3.660	3.660	3.660	3.660	3.660
Total P appln.(lb/a)	34.73	35.31	34.44	35.18	34.91
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.2800E-01	0.3200E-01	0.2900E-01	0.9000E-02	0.2450E-01
Upper	50.92	66.75	69.14	82.11	67.23
Lower	48.80	43.56	38.66	33.96	41.24
Total	99.74	110.3	107.8	116.1	108.5
Phosphorus					
Surface	0.2300E-01	0.2700E-01	0.2600E-01	0.9000E-02	0.2125E-01
Upper	22.14	20.99	21.84	23.72	22.18
Lower	2.802	2.801	2.801	2.801	2.801
Total	24.97	23.82	24.67	26.53	25.00
Deficit (lb/a)					
Nitrogen					
Surface	1.523	1.519	1.522	1.542	1.526
Upper	54.23	38.41	36.02	23.05	37.93
Lower	0.0000	5.245	10.11	14.77	7.531
Total	55.76	45.17	47.66	39.36	46.99
Phosphorus					
Surface	1.378	1.373	1.375	1.392	1.379
Upper	1.686	2.824	1.972	0.9997E-01	1.645
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	3.064	4.198	3.347	1.492	3.025
Other Fluxes-lb/ac					
N Mineralization	18.00	16.38	13.66	12.98	15.26
P Mineralization	3.512	3.694	3.627	3.532	3.591
Denitrification	2.746	2.028	1.039	0.3278	1.535
N Immobilization	20.09	19.94	19.41	19.19	19.66
P Immobilization	8.317	11.06	9.557	6.101	8.759

AGCHEM RESULTS FOR MONOCACY (HAY), SEGMENT 216

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	47.38	37.01	35.51	38.42	39.58
Runoff (in)					
Surface	10.41	2.599	3.321	3.467	4.949
Interflow	4.943	2.559	2.364	2.579	3.111
Baseflow	8.113	5.155	4.462	5.727	5.864
Total	23.46	10.31	10.15	11.77	13.92
Sediment Loss (t/a)	0.2490	0.3629E-01	0.7221E-01	0.7791E-01	0.1089
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.6408	0.1460	0.1505	0.1557	0.2733
Interflow	0.9947	0.4207	0.4446	0.3201	0.5450
Baseflow	2.773	1.625	2.068	2.750	2.304
Total	4.408	2.191	2.663	3.226	3.122
NH3 Loss					
Surface	0.6251	0.1288	0.1186	0.1677	0.2601
Interflow	0.3949E-01	0.5839E-01	0.5495E-01	0.5725E-01	0.5252E-01
Baseflow	0.4822E-01	0.1501E-01	0.8874E-02	0.8292E-02	0.2010E-01
Sediment	0.2535E-02	0.3085E-03	0.6609E-03	0.7432E-03	0.1062E-02
Total	0.7153	0.2025	0.1831	0.2340	0.3337
ORGN Sediment	0.6487	0.8139E-01	0.1814	0.1972	0.2772
Total N Loss (lb/a)	5.772	2.475	3.027	3.657	3.733
PO4 Loss					
Surface	0.8819	0.2440	0.2528	0.3328	0.4279
Interflow	0.1707	0.2071E-01	0.1668E-01	0.3125E-01	0.5984E-01
Baseflow	0.1243E-02	0.2890E-04	0.2480E-04	0.2545E-04	0.3305E-03
Sediment	0.1019E-01	0.1317E-02	0.2723E-02	0.3146E-02	0.4344E-02
Total	1.064	0.2661	0.2722	0.3673	0.4924
ORGP Sediment	0.1738	0.2186E-01	0.4927E-01	0.5358E-01	0.7463E-01
Total P Loss (lb/a)	1.238	0.2879	0.3215	0.4208	0.5670
Atm Depn. NO3 (lb/a)	7.537	6.682	6.514	6.913	6.911
Atm Depn. NH4 (lb/a)	2.396	1.904	1.691	2.022	2.003
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	7.353	7.380	7.380	7.380	7.373
Nitrate appln.(lb/a)	0.3810	0.3900	0.3900	0.3900	0.3877
ORGN appln.(lb/a)	8.160	8.160	8.160	8.160	8.160
Total N appln.(lb/a)	15.89	15.93	15.93	15.93	15.92
PO4-p appln.(lb/a)	13.59	13.87	13.87	13.87	13.80
ORGP appln.(lb/a)	2.160	2.160	2.160	2.160	2.160
Total P appln.(lb/a)	15.75	16.03	16.03	16.03	15.96
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.9000E-02	0.3000E-02	0.2000E-02	0.6000E-02	0.5000E-02
Upper	11.84	12.56	11.72	13.69	12.45
Lower	12.58	12.58	12.58	12.58	12.58
Total	24.43	25.14	24.30	26.27	25.03
Phosphorus					
Surface	0.2100E-01	0.8000E-02	0.3000E-02	0.1200E-01	0.1100E-01
Upper	14.18	12.98	12.50	12.69	13.09
Lower	2.002	2.001	2.001	2.001	2.001
Total	16.20	14.99	14.51	14.70	15.10
Deficit (lb/a)					
Nitrogen					
Surface	0.3914	0.3967	0.3986	0.3946	0.3953
Upper	15.30	14.58	15.42	13.45	14.69
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	15.69	14.98	15.82	13.85	15.08
Phosphorus					
Surface	0.9803	0.9927	0.9970	0.9882	0.9895
Upper	2.836	4.028	4.505	4.317	3.921
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	3.817	5.020	5.502	5.306	4.911
Other Fluxes-lb/ac					
N Mineralization	17.33	17.33	17.08	17.33	17.27
P Mineralization	2.991	2.766	2.637	2.649	2.761
Denitrification	0.8972	1.248	1.709	1.752	1.402
N Immobilization	2.698	3.355	3.221	3.318	3.148
P Immobilization	3.393	2.116	2.006	2.134	2.412

AGCHEM RESULTS FOR MONOCACY (HAY), SEGMENT 216

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	35.70	41.36	45.15	35.53	39.43
Runoff (in)					
Surface	4.618	5.942	5.582	4.687	5.207
Interflow	2.128	3.431	3.439	2.115	2.778
Baseflow	4.647	6.300	5.634	4.744	5.331
Total	11.39	15.67	14.66	11.55	13.32
Sediment Loss (t/a)	0.2050	0.1970	0.1340	0.3230	0.2148
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.2377	0.3635	0.2360	0.1867	0.2560
Interflow	0.3526	0.3212	0.4715	0.3672	0.3781
Baseflow	2.220	3.027	2.304	1.781	2.333
Total	2.810	3.712	3.012	2.334	2.967
NH3 Loss					
Surface	0.2132	0.5312	0.2639	0.1963	0.3012
Interflow	0.6506E-01	0.6858E-01	0.6590E-01	0.5529E-01	0.6371E-01
Baseflow	0.5186E-02	0.5753E-02	0.4362E-02	0.3449E-02	0.4688E-02
Sediment	0.2136E-02	0.2094E-02	0.1339E-02	0.3528E-02	0.2274E-02
Total	0.2856	0.6076	0.3355	0.2585	0.3718
ORGN Sediment	0.5502	0.5246	0.3526	0.9051	0.5831
Total N Loss (lb/a)	3.646	4.844	3.700	3.498	3.922
PO4 Loss					
Surface	0.2215	0.9300	0.4127	0.4031	0.4918
Interflow	0.1426E-01	0.3110E-01	0.3531E-01	0.3267E-01	0.2833E-01
Baseflow	0.1721E-04	0.2318E-04	0.1808E-04	0.9650E-05	0.1703E-04
Sediment	0.8645E-02	0.8944E-02	0.5516E-02	0.1566E-01	0.9691E-02
Total	0.2444	0.9701	0.4536	0.4514	0.5299
ORGP Sediment	0.1471	0.1406	0.9556E-01	0.2478	0.1578
Total P Loss (lb/a)	0.3915	1.111	0.5491	0.6993	0.6877
Atm Depn. NO3 (lb/a)	6.617	7.267	7.268	6.486	6.910
Atm Depn. NH4 (lb/a)	1.905	2.341	2.248	1.723	2.054
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	7.380	7.380	7.380	7.370	7.378
Nitrate appln.(lb/a)	0.3900	0.3900	0.3900	0.3860	0.3890
ORGN appln.(lb/a)	8.160	8.160	8.160	8.160	8.160
Total N appln.(lb/a)	15.93	15.93	15.93	15.92	15.93
PO4-p appln.(lb/a)	13.87	13.87	13.87	13.77	13.84
ORGP appln.(lb/a)	2.160	2.160	2.160	2.160	2.160
Total P appln.(lb/a)	16.03	16.03	16.03	15.93	16.00
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.6000E-02	0.8000E-02	0.6000E-02	0.3000E-02	0.5750E-02
Upper	12.66	13.77	14.21	11.99	13.16
Lower	12.58	12.58	12.58	12.58	12.58
Total	25.25	26.35	26.79	24.57	25.74
Phosphorus					
Surface	0.1400E-01	0.1900E-01	0.1500E-01	0.6000E-02	0.1350E-01
Upper	12.24	12.75	12.48	11.14	12.15
Lower	2.002	2.001	2.001	2.001	2.001
Total	14.26	14.77	14.50	13.15	14.17
Deficit (lb/a)					
Nitrogen					
Surface	0.3941	0.3924	0.3941	0.3976	0.3945
Upper	14.47	13.37	12.93	15.15	13.98
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	14.87	13.77	13.33	15.55	14.38
Phosphorus					
Surface	0.9867	0.9819	0.9860	0.9942	0.9872
Upper	4.771	4.260	4.528	5.873	4.858
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	5.758	5.241	5.514	6.867	5.845
Other Fluxes-lb/ac					
N Mineralization	17.95	17.50	17.58	17.19	17.56
P Mineralization	2.681	2.786	2.698	2.456	2.655
Denitrification	1.754	1.722	1.535	1.550	1.640
N Immobilization	3.539	3.392	3.456	3.324	3.428
P Immobilization	2.385	1.694	2.253	2.770	2.275

Per Acre Load Contributed from Each Land Use in Monocacy Basin (lb/ac)

Segment 210

	Pervious FOR	HTC	LTC	PAS	URB	HAY	Impervious ANML	RES	Total Load
NH3									
84	0.09175	2.56	2.332	0.133	0.385	0.7153	288.9274	1.46	0.97515
85	0.0436	1.554	1.106	0.05861	0.151	0.2025	208.1008	1.34	0.500427
86	0.03996	1.851	1.565	0.06723	0.171	0.1831	210.0806	1.38	0.615396
87	0.04943	1.663	1.235	0.07808	0.2	0.234	206.2386	1.4	0.547111
88	0.04404	2.097	1.897	0.06389	0.197	0.2856	191.1056	1.32	0.711705
89	0.06213	2.836	2.578	0.09665	0.277	0.6076	228.8838	1.43	0.984982
90	0.05813	2.435	2.349	0.09967	0.262	0.3355	253.7166	1.44	0.874533
91	0.04614	1.316	1.087	0.09858	0.305	0.2585	189.1078	1.34	0.495924
1992	0.054398	2.039	1.768625	0.086964	0.2435	0.352762	222.0201	1.38875	0.713153
NO3									
84	2.87	10.87	11.89	8.360001	10.6	4.408	72.23186	3.13	6.604238
85	1.41	9.294	10.83	4.83	6.14	2.191	52.0252	2.86	4.723645
86	1.35	6.535	3.185	4.37	5.56	2.663	52.52015	2.95	2.905484
87	1.6	7.13	2.99	5.28	6.6	3.226	51.55964	3.01	3.248722
88	1.34	11.02	12.73	4.27	5.51	2.81	47.7764	2.82	5.207224
89	1.83	15.18	14.97	6.15	7.9	3.712	57.22094	3.06	6.626168
90	1.81	8.294	9.133	5.98	7.53	3.012	63.42916	3.08	4.798737
91	1.52	3.355	1.878	4.71	6.12	2.334	47.27694	2.88	2.500029
1992	1.71625	8.95975	8.45075	5.49375	6.995	3.0445	55.50504	2.97375	4.576781
ORGN									
84	0.180677	1.917	1.095	2.25939	2.35214	0.6487	2166.956	3.2648	1.770999
85	0.046746	0.3386	0.1713	0.5936	0.63812	0.08139	1560.756	2.97913	0.820372
86	0.061957	0.7584	0.406	1.09445	0.9275	0.1814	1575.604	3.07188	1.003806
87	0.062328	0.6509	0.3094	1.19091	1.05735	0.1972	1546.789	3.13495	0.988334
88	0.206276	1.762	1.061	0.97944	1.16865	0.5502	1433.292	2.93461	1.259294
89	0.168063	1.594	0.9401	1.59159	1.64353	0.5246	1716.628	3.18318	1.412373
90	0.08904	1.274	0.6174	1.84387	1.57304	0.3526	1902.875	3.20544	1.364766
91	0.124285	3.179	1.817	2.24826	2.1889	0.9051	1418.308	3.00139	1.741752
1992	0.117422	1.434237	0.80215	1.475189	1.443654	0.430149	1665.151	3.096923	1.295212
TN									
84	3.142427	15.35	15.31	10.75239	13.33714	5.772	2528.115	7.8548	9.3491
85	1.500346	11.19	12.11	5.48221	6.92912	2.475	1820.882	7.17913	6.045249
86	1.451917	9.145	5.156	5.531681	6.6585	3.027	1838.205	7.40188	4.524644
87	1.711758	9.443999	4.535	6.54899	7.85735	3.657	1804.587	7.54495	4.784267
88	1.590316	14.88	15.69	5.31333	6.87565	3.646	1672.174	7.07461	7.178741
89	2.060193	19.61	18.49	7.83824	9.82053	4.844	2002.733	7.67318	9.023892
90	1.95717	12.0	12.1	7.92354	9.36504	3.7	2220.021	7.72544	7.037954
91	1.690425	7.85	4.782	7.05684	8.6139	3.498	1654.693	7.22139	4.737769
1992	1.888069	12.43363	11.02162	7.055902	8.682154	3.827375	1942.676	7.459423	6.585202
PO4									
84	0.009871	1.242	1.227	0.07438	0.302	1.064	72.23186	0.677	0.577228
85	0.002622	0.8199	0.5891	0.02609	0.08224	0.2661	52.0252	0.621	0.260204
86	0.002995	0.704	0.4451	0.03607	0.119	0.2722	52.52015	0.64	0.226946
87	0.00327	0.7574	0.5173	0.03951	0.133	0.3673	51.55964	0.653	0.262034
88	0.006409	1.372	1.592	0.03251	0.147	0.2444	47.7764	0.612	0.506844
89	0.00672	1.256	1.322	0.05236	0.21	0.9701	57.22094	0.664	0.56951
90	0.0047	1.396	1.279	0.0577	0.202	0.4536	63.42916	0.668	0.487915
91	0.007007	0.5653	0.435	0.0604	0.274	0.4514	47.27694	0.625	0.253682
1992	0.005449	1.014075	0.925813	0.047378	0.183655	0.511137	55.50504	0.645	0.393045
ORGP									
84	0.025811	0.5309	0.2911	0.32277	0.33602	0.1738	433.3911	0.4664	0.355428
85	0.006678	0.09394	0.0457	0.0848	0.09116	0.02186	312.1512	0.42559	0.158274
86	0.008851	0.2102	0.1083	0.15635	0.1325	0.04927	315.1209	0.43884	0.196636
87	0.008904	0.1802	0.08237	0.17013	0.15105	0.05358	309.3578	0.44785	0.19067
88	0.029468	0.4871	0.2827	0.13992	0.16695	0.1471	286.6584	0.41923	0.263099
89	0.024009	0.4414	0.2502	0.22737	0.23479	0.1406	343.3257	0.45474	0.285722
90	0.01272	0.3527	0.1647	0.26341	0.22472	0.09556	380.575	0.45792	0.268374
91	0.017755	0.8822	0.4859	0.32118	0.3127	0.2478	283.6617	0.42877	0.372197
1992	0.016774	0.39733	0.213871	0.210741	0.206236	0.116196	333.0302	0.442418	0.2613

Segment 210

	FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Total Load
	<-----------------------	Pervious				------------------->	<----Impervious	---->	
TP									
84	0.035682	1.773	1.518	0.39715	0.63802	1.238	505.623	1.1434	0.932674
85	0.0093	0.9138	0.6348	0.11089	0.1734	0.2879	364.1764	1.04659	0.418465
86	0.011846	0.9142	0.5534	0.19242	0.2515	0.3215	367.641	1.07884	0.423587
87	0.012174	0.9376	0.5997	0.20964	0.28405	0.4208	360.9174	1.10085	0.452697
88	0.035877	1.86	1.875	0.17243	0.31395	0.3915	334.4348	1.03123	0.770064
89	0.030729	1.697	1.572	0.27973	0.44479	1.111	400.5466	1.11874	0.855212
90	0.01742	1.749	1.444	0.32111	0.42672	0.5491	444.0041	1.12592	0.756362
91	0.024762	1.447	0.9209	0.38158	0.5867	0.6993	330.9386	1.05377	0.625863
MEAN	0.022224	1.41145	1.139725	0.258119	0.389891	0.627387	388.5352	1.087418	0.654365
BOD									
84	4.87	47.1	23.88	60.9	63.4	23.4	5056.23	26.4	26.65551
85	1.26	11.67	7.110001	16.0	17.2	3.99	3641.764	24.09	8.019609
86	1.67	16.92	8.97	29.5	25.0	6.09	3676.41	24.84	11.36651
87	1.68	20.07	9.81	32.1	28.5	8.940001	3609.175	25.35	12.6823
88	5.56	36.0	21.33	26.4	31.5	21.27	3344.348	23.73	18.78904
89	4.53	36.6	21.39	42.9	44.3	21.24	4005.466	25.74	21.43853
90	2.4	35.1	16.05	49.7	42.4	14.85	4440.041	25.92	19.3798
91	3.35	86.7	35.4	60.6	59.0	35.1	3309.386	24.27	32.05347
MEAN	3.165	36.27	17.9925	39.7625	38.9125	16.86	3885.352	25.0425	18.7981
SED									
84	0.01874	0.591	0.27	0.239	0.231	0.249	0.0	0.0	0.182825
85	0.001111	0.111	0.04788	0.0564	0.0446	0.03629	0.0	0.0	0.032731
86	0.004392	0.231	0.102	0.116	0.08353	0.07221	0.0	0.0	0.068283
87	0.002938	0.2	0.07806	0.125	0.09462	0.07791	0.0	0.0	0.063274
88	0.03078	0.532	0.257	0.103	0.114	0.205	0.0	0.0	0.150915
89	0.0208	0.484	0.231	0.168	0.159	0.197	0.0	0.0	0.147809
90	0.005715	0.384	0.154	0.198	0.152	0.134	0.0	0.0	0.113114
91	0.02158	0.94	0.433	0.249	0.239	0.323	0.0	0.0	0.254175
MEAN	0.013257	0.434125	0.196617	0.1568	0.139719	0.161801	0.0	0.0	0.126641

Segment 750

	<------	------	Pervious	------	------	------>	<---Impervious	--->	Total
	FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Load
NH3									
84	0.09233	2.143	1.915	0.153	0.48	0.789	326.8683	1.46	0.881907
85	0.06063	2.058	1.698	0.106	0.297	0.3016	266.4359	1.38	0.705342
86	0.05258	3.462	2.584	0.08943	0.248	0.3093	253.7347	1.4	0.987107
87	0.04041	1.57	1.154	0.06618	0.168	0.3169	197.7138	1.4	0.521905
88	0.03487	1.844	1.846	0.05131	0.15	0.2345	178.8383	1.31	0.668202
89	0.06344	4.527	3.772	0.101	0.284	0.6103	246.9185	1.44	1.378083
90	0.0633	2.528	2.337	0.116	0.353	0.3229	277.8625	1.45	0.890467
91	0.04263	1.234	1.047	0.08112	0.243	0.2511	182.2916	1.38	0.466266
MEAN	0.056274	2.42075	2.044125	0.095505	0.277875	0.39195	241.3329	1.4025	0.81241
NO3									
84	2.85	9.388	10.94	8.01	10.3	4.763	81.71707	3.14	6.426301
85	1.98	6.87	7.231	6.02	7.61	2.649	66.60898	2.95	4.394911
86	1.79	9.567	6.273	5.37	6.81	3.466	63.43368	3.01	4.316612
87	1.33	5.084	3.737	4.24	5.29	2.889	49.42846	3.0	2.982077
88	1.11	9.488	12.03	3.56	4.54	2.813	44.70958	2.8	4.893993
89	1.86	15.36	16.79	5.89	7.44	3.938	61.72964	3.08	7.231478
90	1.99	8.396	9.661001	6.24	8.02	3.396	69.46562	3.1	5.214621
91	1.44	2.918	1.513	4.25	5.46	2.496	45.5729	2.95	2.322343
MEAN	1.79375	8.383875	8.521875	5.4475	6.93375	3.30125	60.33324	3.00375	4.722792
ORGN									
84	0.55279	5.21	3.278	3.21657	3.339	1.612	2451.512	3.27222	2.758922
85	0.102025	1.362	0.762	2.10357	1.91807	0.4597	1998.269	3.07188	1.276025
86	0.117236	1.673	0.8339	1.64353	1.53223	0.3873	1903.01	3.13124	1.206273
87	0.050085	0.7046	0.3179	1.09445	0.91637	0.186	1482.854	3.12382	0.771992
88	0.080878	0.8249	0.4472	0.74942	0.8533	0.2211	1341.287	2.91977	0.737146
89	0.201824	2.515	1.445	1.85871	1.7808	0.7726	1851.889	3.20915	1.521105
90	0.228536	2.958	1.689	2.43747	2.42263	0.9073	2083.969	3.22399	1.796147
91	0.087927	2.873	1.564	1.71773	1.66579	0.6968	1367.187	3.07559	1.378968
MEAN	0.177663	2.265063	1.292125	1.852681	1.803524	0.65535	1809.997	3.128458	1.430822
TN									
84	3.49512	16.74	16.14	11.37957	14.119	7.163	2860.097	7.87222	10.06844
85	2.142655	10.29	9.691001	8.22957	9.82507	3.41	2331.314	7.40188	6.376228
86	1.959816	14.7	9.691001	7.10296	8.59023	4.163	2220.179	7.54124	6.509948
87	1.420495	7.359	5.209	5.40063	6.37437	3.392	1729.996	7.52382	4.27604
88	1.225748	12.16	14.33	4.36073	5.5433	3.268	1564.835	7.02977	6.300951
89	2.125264	22.41	22.0	7.84971	9.5048	5.321	2160.537	7.72915	10.12967
90	2.281836	13.88	13.69	8.793469	10.79563	4.626	2431.297	7.77399	7.90173
91	1.570557	7.025	4.125	6.04885	7.36879	3.444	1595.051	7.40559	4.167815
MEAN	2.027686	13.0705	11.8595	7.395686	9.015149	4.348375	2111.663	7.534708	6.966353
PO4									
84	0.02156	1.122	1.184	0.09298	0.424	1.284	81.71707	0.679	0.625552
85	0.005682	1.066	0.7256	0.06431	0.247	0.4217	66.60898	0.641	0.353882
86	0.005176	0.9512	0.6883	0.05185	0.197	0.4775	63.43368	0.653	0.343097
87	0.002682	0.6846	0.4702	0.03494	0.116	0.3016	49.42846	0.651	0.237612
88	0.003258	1.157	1.401	0.02635	0.109	0.188	44.70958	0.608	0.452506
89	0.01142	1.618	1.723	0.05767	0.228	1.217	61.72964	0.669	0.745784
90	0.008136	1.62	1.488	0.07163	0.31	0.3754	69.46562	0.672	0.557404
91	0.005329	0.6347	0.4684	0.04854	0.21	0.3716	45.5729	0.641	0.250999
MEAN	0.007905	1.106688	1.018563	0.056034	0.230125	0.5796	60.33324	0.65175	0.445854
ORGP									
84	0.07897	1.445	0.8733	0.45951	0.477	0.4336	490.3025	0.46746	0.597826
85	0.014575	0.3773	0.203	0.30051	0.27401	0.1243	399.6539	0.43884	0.252014
86	0.016748	0.4638	0.2224	0.23479	0.21889	0.1054	380.6021	0.44732	0.244161
87	0.007155	0.1955	0.08488	0.15635	0.13091	0.05049	296.5707	0.44626	0.149261
88	0.011554	0.2284	0.1194	0.10706	0.1219	0.05919	268.2575	0.41711	0.147612
89	0.028832	0.6964	0.3855	0.26553	0.2544	0.2082	370.3778	0.45845	0.320814
90	0.032648	0.8206	0.4518	0.34821	0.34609	0.2479	416.7938	0.46057	0.377705
91	0.012561	0.7986	0.4194	0.24539	0.23797	0.1921	273.4374	0.43937	0.300282
MEAN	0.02538	0.6282	0.34496	0.264669	0.257646	0.177648	361.9995	0.446923	0.29871

Segment 750

	<---------Pervious					---------><----Impervious	---->	Total
	FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Load
TP									
84	0.10053	2.567	2.057	0.55249	0.901	1.717	572.0195	1.14646	1.22321
85	0.020257	1.444	0.9286	0.36482	0.52101	0.546	466.2628	1.07984	0.605943
86	0.021924	1.415	0.9107	0.28664	0.41589	0.5829	444.0357	1.10032	0.587258
87	0.009837	0.8801	0.555	0.19129	0.24691	0.3521	345.9992	1.09726	0.386857
88	0.014812	1.386	1.521	0.13341	0.2309	0.2472	312.9671	1.02511	0.600293
89	0.040252	2.314	2.108	0.3232	0.4824	1.426	432.1075	1.12745	1.066596
90	0.040784	2.441	1.939	0.41984	0.65609	0.6233	486.2593	1.13257	0.934959
91	0.01789	1.433	0.8878	0.29393	0.44797	0.5637	319.0103	1.08037	0.551261
MEAN	0.033286	1.735012	1.363387	0.320702	0.487771	0.757275	422.3327	1.098673	0.744547
BOD									
84	14.9	115.2	54.6	86.7	90.0	54.0	5720.195	26.46	51.43396
85	2.75	38.1	18.24	56.7	51.7	18.54	4662.628	24.84	22.15917
86	3.16	36.9	15.18	44.3	41.3	11.61	4440.357	25.32	18.21376
87	1.35	20.1	9.18	29.5	24.7	8.01	3459.992	25.26	11.61559
88	2.18	18.72	11.07	20.2	23.0	9.210001	3129.671	23.61	10.96228
89	5.44	53.1	30.3	50.1	48.0	30.3	4321.075	25.95	27.63228
90	6.16	77.4	34.2	65.7	65.3	34.8	4862.594	26.07	34.08295
91	2.37	79.2	31.2	46.3	44.9	27.12	3190.103	24.87	27.05357
MEAN	4.78875	54.84	25.49625	49.9375	48.6125	24.19875	4223.327	25.2975	25.3942
SED									
84	0.09842	1.58	0.795	0.351	0.357	0.589	0.0	0.0	0.477249
85	0.008354	0.41	0.188	0.228	0.194	0.172	0.0	0.0	0.139986
86	0.01195	0.503	0.204	0.176	0.151	0.146	0.0	0.0	0.137735
87	0.002153	0.215	0.08113	0.116	0.08411	0.07267	0.0	0.0	0.064646
88	0.008838	0.252	0.113	0.07736	0.07976	0.08551	0.0	0.0	0.073125
89	0.0367	0.754	0.354	0.2	0.178	0.286	0.0	0.0	0.224237
90	0.0309	0.879	0.406	0.266	0.255	0.328	0.0	0.0	0.261316
91	0.01265	0.849	0.372	0.188	0.177	0.249	0.0	0.0	0.218378
MEAN	0.026246	0.68025	0.314141	0.200295	0.184484	0.241022	0.0	0.0	0.199584

Percent of Total Load Contributed from Each Land Use in Monocacy Basin

Segment 210

		Pervious						Impervious			
		FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Point Source	Total Load
NH3											
	84	1.81	8.76	26.36	0.94	0.84	6.18	5.55	1.77	47.80	100.00
	85	1.13	7.01	16.48	0.55	0.43	2.31	5.28	2.14	64.66	100.00
	86	0.96	7.69	21.47	0.58	0.45	1.92	4.90	2.03	59.99	100.00
	87	1.24	7.26	17.81	0.70	0.56	2.58	5.06	2.16	62.61	100.00
	88	0.93	7.73	23.09	0.49	0.46	2.66	3.96	1.72	58.96	100.00
	89	1.08	8.57	25.74	0.60	0.53	4.64	3.89	1.53	53.41	100.00
	90	1.07	7.76	24.74	0.66	0.53	2.70	4.55	1.62	56.36	100.00
	91	1.13	5.62	15.33	0.87	0.83	2.79	4.54	2.02	66.86	100.00
MEAN		1.17	7.64	21.91	0.67	0.58	3.34	4.68	1.84	58.17	100.00
NO3											
	84	14.60	9.61	34.71	15.26	5.98	9.85	0.36	0.98	8.65	100.00
	85	9.67	11.07	42.61	11.88	4.67	6.59	0.35	1.20	11.95	100.00
	86	13.98	11.76	18.93	16.23	6.39	12.10	0.53	1.88	18.18	100.00
	87	15.13	11.71	16.23	17.91	6.92	13.39	0.48	1.75	16.48	100.00
	88	8.32	11.88	45.35	9.51	3.80	7.66	0.29	1.08	12.09	100.00
	89	9.08	13.08	42.60	10.94	4.35	8.08	0.28	0.93	10.66	100.00
	90	11.91	9.48	34.50	14.12	5.50	8.71	0.41	1.25	14.14	100.00
	91	17.47	6.70	12.39	19.42	7.80	11.77	0.53	2.03	21.89	100.00
MEAN		11.98	10.86	33.84	13.75	5.41	9.33	0.38	1.27	13.16	100.00
ORGN											
	84	3.26	6.01	11.34	14.62	4.71	5.14	38.17	3.62	13.14	100.00
	85	1.57	1.98	3.30	7.15	2.38	1.20	51.19	6.15	25.08	100.00
	86	1.78	3.78	6.69	11.28	2.95	2.29	44.19	5.42	21.62	100.00
	87	1.81	3.29	5.17	12.44	3.42	2.52	43.98	5.61	21.75	100.00
	88	4.84	7.19	14.30	8.25	3.05	5.67	32.87	4.24	19.59	100.00
	89	3.53	5.82	11.33	11.99	3.83	4.84	35.21	4.11	19.35	100.00
	90	1.92	4.78	7.65	14.29	3.77	3.34	40.11	4.25	19.89	100.00
	91	2.24	9.95	18.79	14.52	4.37	7.16	24.94	3.32	14.70	100.00
MEAN		2.71	5.75	10.63	12.22	3.70	4.36	37.54	4.39	18.67	100.00
TN											
	84	10.38	8.81	29.03	12.74	4.89	8.37	8.15	1.59	16.04	100.00
	85	7.01	9.08	32.44	9.18	3.59	5.07	8.30	2.06	23.26	100.00
	86	8.38	9.17	17.09	11.46	4.26	7.68	10.37	2.63	28.98	100.00
	87	9.52	9.12	14.47	13.06	4.85	8.93	9.80	2.58	27.69	100.00
	88	6.34	10.31	35.91	7.60	3.04	6.38	6.51	1.73	22.17	100.00
	89	6.72	11.11	34.59	9.17	3.55	6.93	6.38	1.54	20.02	100.00
	90	7.74	8.25	27.49	11.25	4.11	6.43	8.58	1.88	24.29	100.00
	91	9.23	7.44	14.98	13.82	5.21	8.38	8.82	2.42	29.70	100.00
MEAN		8.11	9.27	27.15	10.86	4.13	7.21	8.14	1.97	23.14	100.00
PO4-P											
	84	0.41	8.98	29.29	1.11	1.39	19.44	2.93	1.73	34.70	100.00
	85	0.16	8.90	21.13	0.58	0.57	7.30	3.17	2.38	55.81	100.00
	86	0.21	8.72	18.23	0.92	0.94	8.53	3.66	2.81	55.93	100.00
	87	0.25	10.22	23.05	1.10	1.15	12.52	3.91	3.12	44.71	100.00
	88	0.31	11.46	43.94	0.56	0.78	5.16	2.24	1.81	33.72	100.00
	89	0.28	9.24	32.12	0.80	0.99	18.03	2.37	1.73	34.44	100.00
	90	0.22	11.33	34.31	0.97	1.05	9.31	2.89	1.92	38.01	100.00
	91	0.44	6.23	15.83	1.37	1.93	12.57	2.93	2.44	56.28	100.00
MEAN		0.29	9.49	28.62	0.92	1.10	12.09	2.92	2.13	42.43	100.00
ORGP											
	84	2.32	8.28	15.00	10.40	3.35	6.85	38.00	2.57	13.22	100.00
	85	1.14	2.78	4.46	5.17	1.72	1.63	51.84	4.45	26.82	100.00
	86	1.32	5.43	9.24	8.33	2.18	3.21	45.73	4.01	20.56	100.00
	87	1.44	5.05	7.63	9.84	2.70	3.79	48.72	4.44	16.39	100.00
	88	3.51	10.08	19.33	5.98	2.21	7.70	33.36	3.07	14.75	100.00
	89	2.61	8.33	15.61	8.86	2.83	6.71	36.42	3.04	15.61	100.00
	90	1.46	7.01	10.82	10.82	2.85	4.80	42.55	3.22	16.44	100.00
	91	1.52	13.12	23.87	9.86	2.97	9.31	23.70	2.25	13.40	100.00
MEAN		1.97	8.12	14.44	8.90	2.69	6.00	38.27	3.20	16.37	100.00

Segment 210

		<-----	-----	Pervious	-----	-----	----->	<----Impervious	-->	Point	Total
		FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Source	Load
TP											
	84	1.01	8.76	24.78	4.05	2.01	15.45	14.04	2.00	27.89	100.00
	85	0.42	7.25	16.64	1.82	0.88	5.77	16.24	2.94	48.01	100.00
	86	0.57	7.66	15.31	3.33	1.34	6.81	17.31	3.20	44.47	100.00
	87	0.64	8.54	18.04	3.94	1.65	9.69	18.47	3.54	35.51	100.00
	88	1.23	11.07	36.87	2.12	1.19	5.89	11.19	2.17	28.28	100.00
	89	0.94	8.98	27.48	3.06	1.50	14.86	11.92	2.09	29.17	100.00
	90	0.58	10.08	27.50	3.82	1.57	8.00	14.38	2.29	31.76	100.00
	91	0.90	9.16	19.25	4.99	2.37	11.18	11.77	2.36	38.02	100.00
MEAN		0.82	9.06	24.17	3.42	1.60	10.18	14.02	2.47	34.25	100.00
BOD											
	84	6.10	10.25	17.17	27.36	8.81	12.87	6.18	2.03	9.25	100.00
	85	4.10	6.59	13.27	18.66	6.20	5.70	11.56	4.81	29.09	100.00
	86	4.13	7.26	12.72	26.15	6.85	6.61	8.87	3.77	23.64	100.00
	87	4.09	8.48	13.70	28.01	7.69	9.55	8.58	3.79	16.10	100.00
	88	8.94	10.06	19.69	15.23	5.62	15.02	5.25	2.34	17.86	100.00
	89	6.53	9.17	17.71	22.19	7.09	13.45	5.64	2.28	15.98	100.00
	90	3.76	9.56	14.44	27.96	7.38	10.23	6.80	2.50	17.37	100.00
	91	3.41	15.33	20.68	22.13	6.66	15.69	3.29	1.52	11.28	100.00
MEAN		5.21	10.38	17.01	23.49	7.11	12.19	6.25	2.53	15.82	100.00
SED											
	84	3.77	20.65	31.18	17.24	5.16	21.99	0.00	0.00	0.00	100.00
	85	1.25	21.66	30.88	22.73	5.56	17.90	0.00	0.00	0.00	100.00
	86	2.37	21.61	31.53	22.41	4.99	17.08	0.00	0.00	0.00	100.00
	87	1.71	20.20	26.05	26.07	6.10	19.89	0.00	0.00	0.00	100.00
	88	7.50	22.53	35.95	9.00	3.08	21.93	0.00	0.00	0.00	100.00
	89	5.18	20.92	32.98	15.00	4.39	21.52	0.00	0.00	0.00	100.00
	90	1.86	21.69	28.75	23.11	5.48	19.13	0.00	0.00	0.00	100.00
	91	3.12	23.64	35.98	12.93	3.84	20.53	0.00	0.00	0.00	100.00
MEAN		3.85	21.90	32.76	16.33	4.50	20.64	0.00	0.00	0.00	100.00

Segment 750

		Pervious						Impervious		Point Source	Total Load
		FOR	HTC	LTC	PAS	URB	HAY	ANML	RES		
NH3											
	84	2.47	11.22	33.11	1.65	1.45	10.43	5.99	2.62	31.05	100.00
	85	1.68	11.13	30.33	1.18	0.93	4.12	5.04	2.56	43.02	100.00
	86	1.35	17.37	42.82	0.93	0.72	3.92	4.45	2.41	26.01	100.00
	87	1.45	11.01	26.75	0.96	0.68	5.62	4.86	3.37	45.32	100.00
	88	1.06	10.98	36.33	0.63	0.52	3.53	3.73	2.68	40.53	100.00
	89	1.20	16.66	45.86	0.77	0.60	5.68	3.18	1.82	24.26	100.00
	90	1.63	12.70	38.81	1.20	1.02	4.10	4.89	2.50	33.13	100.00
	91	1.61	9.10	25.52	1.24	1.03	4.68	4.71	3.50	48.62	100.00
MEAN		1.54	12.98	36.22	1.06	0.86	5.31	4.53	2.58	34.93	100.00
NO3											
	84	14.57	9.37	36.09	16.51	5.93	12.02	0.29	1.08	4.15	100.00
	85	14.23	9.65	33.54	17.45	6.16	9.40	0.33	1.42	7.82	100.00
	86	13.45	14.05	30.42	16.28	5.76	12.86	0.33	1.52	5.33	100.00
	87	13.87	10.36	25.16	17.84	6.21	14.88	0.35	2.10	9.22	100.00
	88	7.30	12.18	51.04	9.44	3.36	9.13	0.20	1.23	6.12	100.00
	89	8.45	13.63	49.24	10.80	3.81	8.84	0.19	0.94	4.10	100.00
	90	12.34	10.17	38.68	15.61	5.60	10.40	0.29	1.29	5.59	100.00
	91	18.76	7.42	12.72	22.33	8.01	16.05	0.41	2.58	11.74	100.00
MEAN		12.23	11.16	37.48	14.97	5.32	11.11	0.28	1.37	6.07	100.00
ORGN											
	84	6.58	12.12	25.19	15.45	4.48	9.48	19.96	2.61	4.14	100.00
	85	2.44	6.35	11.74	20.25	5.16	5.42	32.61	4.92	11.13	100.00
	86	3.07	8.55	14.08	17.34	4.51	5.00	34.03	5.49	7.95	100.00
	87	1.90	5.23	7.80	16.77	3.92	3.49	38.53	7.96	14.38	100.00
	88	3.17	6.32	11.31	11.85	3.77	4.28	35.96	7.68	15.64	100.00
	89	4.18	10.18	19.33	15.54	4.16	7.91	26.25	4.46	8.00	100.00
	90	4.06	10.27	19.37	17.47	4.85	7.96	25.32	3.84	6.86	100.00
	91	1.99	12.72	22.88	15.70	4.25	7.80	21.19	4.68	8.75	100.00
MEAN		3.90	9.71	18.30	16.40	4.46	7.10	27.16	4.61	8.38	100.00
TN											
	84	11.03	10.32	32.86	14.48	5.02	11.16	6.17	1.67	7.31	100.00
	85	9.87	9.26	28.80	15.29	5.10	7.75	7.34	2.29	14.32	100.00
	86	9.32	13.66	29.75	13.63	4.60	9.78	7.22	2.41	9.64	100.00
	87	9.47	9.58	22.41	14.52	4.79	11.16	7.89	3.37	16.83	100.00
	88	5.82	11.29	43.94	8.36	2.97	7.67	5.08	2.24	12.63	100.00
	89	6.61	13.63	44.18	9.86	3.33	8.18	4.60	1.61	8.01	100.00
	90	8.90	10.58	34.46	13.84	4.74	8.91	6.48	2.03	10.05	100.00
	91	10.66	9.31	18.06	16.55	5.63	11.54	7.40	3.37	17.47	100.00
MEAN		8.86	11.16	33.45	13.04	4.44	9.39	6.31	2.21	11.13	100.00
PO4											
	84	1.12	11.34	39.55	1.94	2.47	32.81	2.89	2.36	5.51	100.00
	85	0.50	18.28	41.11	2.28	2.44	18.28	4.00	3.78	9.33	100.00
	86	0.47	16.98	40.59	1.91	2.03	21.55	3.96	4.00	8.51	100.00
	87	0.33	16.52	37.51	1.74	1.61	18.40	4.18	5.40	14.33	100.00
	88	0.23	15.67	62.67	0.74	0.85	6.43	2.12	2.83	8.47	100.00
	89	0.52	14.26	50.16	1.05	1.16	27.10	1.90	2.02	1.83	100.00
	90	0.49	18.98	57.60	1.73	2.09	11.12	2.85	2.70	2.43	100.00
	91	0.69	16.04	39.10	2.53	3.06	23.74	4.03	5.56	5.24	100.00
MEAN		0.57	15.62	47.50	1.63	1.87	20.67	2.98	3.16	6.01	100.00
ORGP											
	84	4.48	16.00	31.96	10.51	3.05	12.14	19.01	1.78	1.07	100.00
	85	1.93	9.77	17.37	16.07	4.09	8.14	36.23	3.90	2.49	100.00
	86	2.30	12.43	19.69	12.99	3.38	7.14	35.70	4.12	2.25	100.00
	87	1.57	8.38	12.02	13.83	3.23	5.47	44.48	6.57	4.49	100.00
	88	2.55	9.86	17.03	9.55	3.03	6.46	40.55	6.19	4.77	100.00
	89	3.06	14.42	26.37	11.35	3.04	10.90	26.85	3.26	0.76	100.00
	90	2.94	14.45	26.28	12.66	3.51	11.03	25.69	2.79	0.65	100.00
	91	1.42	17.66	30.64	11.20	3.03	10.74	21.16	3.34	0.81	100.00
MEAN		2.86	13.84	25.12	12.04	3.27	9.90	27.92	3.38	1.66	100.00

Segment 750

		<---Pervious					---><----	Impervious-->	Point	Total
		FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Source	Load
TP											
	84	2.72	13.57	35.93	6.03	2.75	22.95	10.58	2.08	3.39	100.00
	85	1.07	14.89	31.65	7.77	3.10	14.24	16.84	3.83	6.60	100.00
	86	1.20	15.17	32.24	6.34	2.57	15.78	16.65	4.05	6.01	100.00
	87	0.78	13.58	28.31	6.10	2.20	13.74	18.69	5.82	10.78	100.00
	88	0.78	14.28	51.78	2.84	1.37	6.44	11.29	3.63	7.58	100.00
	89	1.27	14.30	43.03	4.12	1.72	22.27	9.34	2.39	1.51	100.00
	90	1.47	17.17	45.07	6.10	2.66	11.08	11.98	2.74	1.72	100.00
	91	1.08	16.89	34.59	7.16	3.05	16.81	13.17	4.38	2.88	100.00
MEAN		1.47	14.92	38.75	5.70	2.42	16.47	12.72	3.25	4.31	100.00
BOD											
	84	9.70	14.65	22.93	22.77	6.60	17.36	2.55	1.16	2.29	100.00
	85	3.99	10.80	17.08	33.18	8.45	13.28	4.63	2.42	6.19	100.00
	86	5.47	12.49	16.98	30.96	8.06	9.93	5.26	2.94	7.90	100.00
	87	3.64	10.60	15.99	32.11	7.51	10.67	6.38	4.57	8.51	100.00
	88	5.85	9.81	19.16	21.86	6.95	12.20	5.74	4.25	14.20	100.00
	89	6.33	12.07	22.76	23.52	6.29	17.41	3.44	2.03	6.15	100.00
	90	5.88	14.43	21.07	25.30	7.02	16.40	3.17	1.67	5.04	100.00
	91	2.81	18.36	23.90	22.17	6.00	15.90	2.59	1.98	6.27	100.00
MEAN		6.09	13.61	20.91	25.60	6.96	15.19	3.67	2.16	5.82	100.00
SED											
	84	7.07	22.15	36.84	10.17	2.89	20.88	0.00	0.00	0.00	100.00
	85	2.04	19.60	29.69	22.51	5.35	20.78	0.00	0.00	0.00	100.00
	86	2.97	24.44	32.75	17.66	4.23	17.93	0.00	0.00	0.00	100.00
	87	1.14	22.26	27.75	24.80	5.02	19.02	0.00	0.00	0.00	100.00
	88	4.14	23.07	34.17	14.62	4.21	19.78	0.00	0.00	0.00	100.00
	89	5.61	22.50	34.91	12.33	3.06	21.58	0.00	0.00	0.00	100.00
	90	4.05	22.52	34.36	14.07	3.77	21.24	0.00	0.00	0.00	100.00
	91	1.99	26.02	37.67	11.90	3.13	19.29	0.00	0.00	0.00	100.00
MEAN		4.51	22.81	34.80	13.87	3.57	20.43	0.00	0.00	0.00	100.00

Appendix D
Alternative Nutrient Reduction Scenario Results for the Shenandoah Model Segments

AGCHEM Summary for Alternative No. 1 for the Shenandoah Basin (Low-Till), PERLND 193

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	43.65	42.99	30.45	43.61	40.17
Runoff (in)					
Surface	10.09	8.250	1.916	7.327	6.896
Interflow	3.565	3.726	1.503	3.193	2.997
Baseflow	7.245	5.996	4.483	5.937	5.915
Total	20.90	17.97	7.901	16.46	15.81
Sediment Loss (t/a)	1.010	1.720	0.1750	1.050	0.9887
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.7622	0.3571	0.8428E-01	0.5882	0.4479
Interflow	9.273	7.700	1.804	5.069	5.962
Baseflow	2.363	0.5107	0.2179	0.7479	0.9599
Total	12.40	8.568	2.106	6.405	7.370
NH3 Loss					
Surface	2.075	0.6477	0.1624	1.275	1.040
Interflow	0.4647	0.8348	0.1421	0.7197	0.5403
Baseflow	0.3688E-01	0.8529E-02	0.2982E-02	0.2417E-02	0.1270E-01
Sediment	0.1121E-01	0.1793E-01	0.1796E-02	0.1152E-01	0.1061E-01
Total	2.588	1.509	0.3092	2.008	1.604
ORGN Sediment	4.233	7.403	0.7436	4.478	4.214
Total N Loss (lb/a)	19.22	17.48	3.159	12.89	13.19
PO4 Loss					
Surface	0.4667	0.6221	0.1754	0.5119	0.4440
Interflow	0.1692	0.2315	0.1270	0.3033	0.2077
Baseflow	0.6353E-03	0.2532E-05	0.4185E-06	0.6229E-06	0.1597E-03
Sediment	0.4795E-01	0.8974E-01	0.9232E-02	0.5822E-01	0.5129E-01
Total	0.6844	0.9433	0.3117	0.8734	0.7032
ORGP Sediment	1.126	1.980	0.1987	1.188	1.123
Total P Loss (lb/a)	1.811	2.924	0.5103	2.061	1.827
Atm Depn. NO3 (lb/a)	6.639	6.417	6.019	6.635	6.428
Atm Depn. NH4 (lb/a)	2.245	2.070	1.775	2.204	2.074
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	100.1	99.93	103.4	103.4	101.7
Nitrate appln.(lb/a)	29.30	29.26	30.41	30.41	29.84
ORGN appln.(lb/a)	17.04	17.04	17.04	17.04	17.04
Total N appln.(lb/a)	146.4	146.2	150.8	150.8	148.6
PO4-P appln.(lb/a)	30.96	31.72	32.98	32.98	32.16
ORGP appln.(lb/a)	4.590	4.590	4.590	4.590	4.590
Total P appln.(lb/a)	35.55	36.31	37.57	37.57	36.75
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.2800E-01	0.2400E-01	0.7000E-02	0.2600E-01	0.2125E-01
Upper	76.05	78.81	92.23	76.42	80.88
Lower	40.02	38.53	35.85	47.04	40.36
Total	116.1	117.4	128.1	123.5	121.3
Phosphorus					
Surface	0.2100E-01	0.1800E-01	0.5000E-02	0.2000E-01	0.1600E-01
Upper	19.92	19.93	19.92	19.91	19.92
Lower	3.753	3.752	1.477	1.819	2.700
Total	23.70	23.70	21.40	21.74	22.64
Deficit (lb/a)					
Nitrogen					
Surface	1.523	1.527	1.544	1.525	1.530
Upper	16.71	13.91	0.5372	16.31	11.87
Lower	21.06	22.38	25.06	13.86	20.59
Total	39.29	37.82	27.14	31.70	33.99
Phosphorus					
Surface	1.230	1.232	1.246	1.231	1.235
Upper	0.1046	0.9227E-01	0.9982E-01	0.1092	0.1015
Lower	0.0000	0.0000	2.275	1.933	1.052
Total	1.335	1.324	3.620	3.273	2.388
Other Fluxes-lb/ac					
N Mineralization	12.83	12.29	13.35	14.06	13.13
P Mineralization	2.681	2.543	1.994	2.178	2.349
Denitrification	1.975	0.7112	0.3953	1.023	1.026
N Immobilization	22.03	22.35	23.29	23.71	22.85
P Immobilization	11.74	12.29	11.04	13.31	12.09

AGCHEM Summary for Alternative No. 1 for the Shenandoah Basin (Low-Till), PERLND 193

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	31.42	45.43	41.84	35.51	38.55
Runoff (in)					
Surface	1.447	7.420	7.087	5.296	5.313
Interflow	1.479	3.951	3.365	2.152	2.737
Baseflow	4.788	7.142	6.262	5.450	5.911
Total	7.713	18.51	16.72	12.90	13.96
Sediment Loss (t/a)	0.7836E-01	0.5170	0.8060	0.5530	0.4886
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.1252	0.6352	0.5142	0.3014	0.3940
Interflow	2.226	12.35	10.27	3.149	6.999
Baseflow	0.3410	0.7292	0.4239	0.2591	0.4383
Total	2.692	13.72	11.21	3.710	7.833
NH3 Loss					
Surface	0.3909	1.060	1.270	0.5741	0.8238
Interflow	0.4488	0.6383	0.9347	0.3315	0.5883
Baseflow	0.1404E-02	0.1794E-02	0.1246E-02	0.1080E-02	0.1381E-02
Sediment	0.8534E-03	0.5845E-02	0.8727E-02	0.6342E-02	0.5442E-02
Total	0.8420	1.706	2.215	0.9131	1.419
ORGN Sediment	0.3091	2.155	3.413	2.340	2.054
Total N Loss (lb/a)	3.843	17.58	16.84	6.962	11.31
PO4 Loss					
Surface	0.1973	0.9302	1.003	0.5963	0.6817
Interflow	0.1075	0.4332	0.3148	0.1721	0.2569
Baseflow	0.3229E-06	0.5080E-06	0.2757E-06	0.2945E-06	0.3503E-06
Sediment	0.4018E-02	0.2859E-01	0.4412E-01	0.3180E-01	0.2713E-01
Total	0.3087	1.392	1.362	0.8002	0.9657
ORGP Sediment	0.8236E-01	0.5745	0.9141	0.6252	0.5490
Total P Loss (lb/a)	0.3911	1.967	2.276	1.425	1.515
Atm Depn. NO3 (lb/a)	5.997	7.040	6.498	6.097	6.408
Atm Depn. NH4 (lb/a)	1.852	2.618	2.130	1.833	2.108
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	103.4	101.3	94.70	102.5	100.5
Nitrate appln.(lb/a)	30.41	29.72	27.51	30.10	29.44
ORGN appln.(lb/a)	17.04	17.04	17.04	17.04	17.04
Total N appln.(lb/a)	150.8	148.1	139.3	149.6	146.9
PO4-P appln.(lb/a)	32.98	32.98	27.94	32.98	31.72
ORGP appln.(lb/a)	4.590	4.590	4.590	4.590	4.590
Total P appln.(lb/a)	37.57	37.57	32.53	37.57	36.31
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.1800E-01	0.4500E-01	0.2000E-01	0.2400E-01	0.2675E-01
Upper	88.78	72.67	70.39	92.45	81.07
Lower	39.96	40.63	35.64	30.01	36.56
Total	128.8	113.3	106.1	122.5	117.7
Phosphorus					
Surface	0.1400E-01	0.3400E-01	0.1500E-01	0.1600E-01	0.1975E-01
Upper	19.91	19.90	19.94	19.95	19.93
Lower	1.456	1.691	0.9290	1.004	1.270
Total	21.38	21.62	20.88	20.97	21.22
Deficit (lb/a)					
Nitrogen					
Surface	1.533	1.505	1.531	1.527	1.524
Upper	3.986	20.05	22.34	0.3154	11.67
Lower	20.95	20.28	25.26	30.90	24.35
Total	26.47	41.83	49.13	32.74	37.54
Phosphorus					
Surface	1.237	1.217	1.236	1.234	1.231
Upper	0.1181	0.1222	0.9433E-01	0.6618E-01	0.1002
Lower	2.297	2.061	2.823	2.748	2.482
Total	3.652	3.400	4.153	4.049	3.813
Other Fluxes-lb/ac					
N Mineralization	14.05	11.89	10.97	13.07	12.49
P Mineralization	2.031	2.239	1.878	1.787	1.984
Denitrification	0.5363	0.9221	0.6157	0.4097	0.6209
N Immobilization	23.04	23.11	20.78	23.20	22.53
P Immobilization	12.69	15.89	7.619	12.07	12.07

AGCHEM Summary for Alternative No. 1 for the Shenandoah Basin (HAY), PERLND 196

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	43.65	42.99	30.45	43.61	40.17
Runoff (in)					
Surface	9.811	7.853	1.582	6.630	6.469
Interflow	2.438	2.491	0.8270	2.157	1.978
Baseflow	7.159	5.821	4.034	5.650	5.666
Total	19.41	16.16	6.444	14.44	14.11
Sediment Loss (t/a)	0.7640	0.7510	0.1110	0.6820	0.5770
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.5828	0.3088	0.8429E-01	0.3184	0.3236
Interflow	1.027	0.7944	0.4079	0.9141	0.7859
Baseflow	3.229	1.735	1.282	2.215	2.115
Total	4.838	2.838	1.774	3.447	3.224
NH3 Loss					
Surface	0.8515	0.3123	0.1464	0.3007	0.4027
Interflow	0.5004E-01	0.6143E-01	0.4895E-01	0.3534E-01	0.4894E-01
Baseflow	0.3678E-01	0.8701E-02	0.2973E-02	0.2611E-02	0.1277E-01
Sediment	0.8097E-02	0.7687E-02	0.1182E-02	0.7179E-02	0.6036E-02
Total	0.9464	0.3902	0.1995	0.3459	0.4705
ORGN Sediment	2.117	2.099	0.3051	1.894	1.604
Total N Loss (lb/a)	7.901	5.327	2.279	5.687	5.299
PO4 Loss					
Surface	1.221	0.4964	0.3754	0.6516	0.6861
Interflow	0.1517	0.1095	0.4109E-01	0.1696	0.1180
Baseflow	0.6425E-03	0.3938E-05	0.7112E-06	0.2610E-06	0.1619E-03
Sediment	0.3849E-01	0.3862E-01	0.6647E-02	0.3837E-01	0.3053E-01
Total	1.412	0.6446	0.4232	0.8595	0.8348
ORGP Sediment	0.5689	0.5838	0.8416E-01	0.5153	0.4380
Total P Loss (lb/a)	1.981	1.228	0.5073	1.375	1.273
Atm Depn. NO3 (lb/a)	6.639	6.417	6.019	6.635	6.428
Atm Depn. NH4 (lb/a)	2.245	2.070	1.775	2.204	2.074
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	23.87	23.87	23.87	23.87	23.87
Nitrate appln.(lb/a)	7.320	7.320	7.320	7.320	7.320
ORGN appln.(lb/a)	2.640	2.640	2.640	2.640	2.640
Total N appln.(lb/a)	33.83	33.83	33.83	33.83	33.83
PO4-p appln.(lb/a)	25.14	25.14	25.14	25.14	25.14
ORGP appln.(lb/a)	1.020	1.020	1.020	1.020	1.020
Total P appln.(lb/a)	26.16	26.16	26.16	26.16	26.16
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.4000E-02	0.4000E-02	0.1000E-02	0.6000E-02	0.3750E-02
Upper	30.05	30.46	30.50	29.80	30.20
Lower	12.84	12.84	12.84	12.84	12.84
Total	42.89	43.30	43.34	42.64	43.04
Phosphorus					
Surface	0.9000E-02	0.8000E-02	0.2000E-02	0.1100E-01	0.7500E-02
Upper	15.94	15.94	15.94	15.93	15.94
Lower	3.002	3.001	2.837	1.431	2.568
Total	18.95	18.95	18.78	17.37	18.51
Deficit (lb/a)					
Nitrogen					
Surface	0.4959	0.4959	0.4994	0.4945	0.4964
Upper	6.684	6.275	6.227	6.915	6.525
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	7.179	6.771	6.726	7.409	7.021
Phosphorus					
Surface	0.9922	0.9923	0.9988	0.9891	0.9931
Upper	0.8367E-01	0.7382E-01	0.7985E-01	0.8734E-01	0.8117E-01
Lower	0.0000	0.0000	0.1649	1.570	0.4337
Total	1.076	1.066	1.243	2.647	1.508
Other Fluxes-lb/ac					
N Mineralization	18.91	18.90	18.74	18.61	18.79
P Mineralization	2.296	2.311	1.993	1.776	2.094
Denitrification	4.025	3.128	3.260	3.915	3.582
N Immobilization	7.312	8.104	8.008	8.015	7.860
P Immobilization	9.665	10.74	8.042	9.695	9.536

AGCHEM Summary for Alternative No. 1 for the Shenandoah Basin (HAY), PERLND 196

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	31.42	45.43	41.84	35.51	38.55
Runoff (in)					
Surface	1.105	7.414	6.983	4.666	5.042
Interflow	0.8380	2.648	2.215	1.403	1.776
Baseflow	4.515	6.778	6.172	5.363	5.707
Total	6.459	16.84	15.37	11.43	12.53
Sediment Loss (t/a)	0.3172E-01	0.3910	0.6190	0.2550	0.3242
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.8179E-01	0.7545	0.3702	0.3388	0.3863
Interflow	0.3157	0.8154	1.002	0.7456	0.7197
Baseflow	1.691	2.562	1.972	1.752	1.994
Total	2.089	4.132	3.344	2.836	3.100
NH3 Loss					
Surface	0.1209	1.443	0.4056	0.4874	0.6142
Interflow	0.2652E-01	0.7031E-01	0.5984E-01	0.3758E-01	0.4856E-01
Baseflow	0.1461E-02	0.1815E-02	0.1432E-02	0.1240E-02	0.1487E-02
Sediment	0.2801E-03	0.4565E-02	0.6504E-02	0.2901E-02	0.3563E-02
Total	0.1492	1.520	0.4733	0.5291	0.6679
ORGN Sediment	0.7136E-01	1.063	1.724	0.6977	0.8890
Total N Loss (lb/a)	2.309	6.715	5.542	4.063	4.657
PO4 Loss					
Surface	0.1806	1.430	0.7649	1.068	0.8609
Interflow	0.4141E-01	0.9248E-01	0.7547E-01	0.5070E-01	0.6502E-01
Baseflow	0.1068E-06	0.6644E-07	0.6761E-07	0.6641E-07	0.7681E-07
Sediment	0.1390E-02	0.2421E-01	0.3383E-01	0.1618E-01	0.1890E-01
Total	0.2234	1.547	0.8742	1.135	0.9449
ORGP Sediment	0.1911E-01	0.2934	0.4769	0.1897	0.2448
Total P Loss (lb/a)	0.2426	1.840	1.351	1.325	1.190
Atm Depn. NO3 (lb/a)	5.997	7.040	6.498	6.097	6.408
Atm Depn. NH4 (lb/a)	1.852	2.618	2.130	1.833	2.108
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	23.87	23.12	23.87	23.35	23.55
Nitrate appln.(lb/a)	7.320	7.070	7.320	7.145	7.214
ORGN appln.(lb/a)	2.640	2.640	2.640	2.640	2.640
Total N appln.(lb/a)	33.83	32.83	33.83	33.13	33.40
PO4-p appln.(lb/a)	25.14	24.31	25.14	24.56	24.79
ORGP appln.(lb/a)	1.020	1.020	1.020	1.020	1.020
Total P appln.(lb/a)	26.16	25.33	26.16	25.58	25.81
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.4000E-02	0.1000E-01	0.4000E-02	0.4000E-02	0.5500E-02
Upper	31.48	29.49	30.10	29.47	30.14
Lower	12.84	12.84	12.84	12.84	12.84
Total	44.32	42.33	42.94	42.31	42.98
Phosphorus					
Surface	0.7000E-02	0.1900E-01	0.8000E-02	0.8000E-02	0.1050E-01
Upper	15.92	15.92	15.94	15.96	15.94
Lower	0.9130	0.8030	0.6730	0.6020	0.7478
Total	16.84	16.74	16.63	16.57	16.69
Deficit (lb/a)					
Nitrogen					
Surface	0.4963	0.4898	0.4959	0.4960	0.4945
Upper	5.249	7.231	6.622	7.269	6.593
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	5.745	7.721	7.118	7.765	7.087
Phosphorus					
Surface	0.9937	0.9814	0.9926	0.9929	0.9901
Upper	0.9447E-01	0.9779E-01	0.7546E-01	0.5295E-01	0.8017E-01
Lower	2.090	2.198	2.328	2.399	2.254
Total	3.178	3.278	3.396	3.445	3.324
Other Fluxes-lb/ac					
N Mineralization	19.03	18.89	18.98	18.79	18.92
P Mineralization	1.597	1.632	1.602	1.485	1.579
Denitrification	3.664	4.061	3.612	3.606	3.736
N Immobilization	8.094	7.771	8.246	7.922	8.008
P Immobilization	9.859	9.637	8.462	6.679	8.659

AGCHEM Summary for Alternative No. 2 for the Shenandoah Basin (Low-Till), PERLND 203

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	39.78	36.84	27.99	37.57	35.54
Runoff (in)					
Surface	7.438	3.413	1.345	3.533	3.932
Interflow	3.401	2.963	1.350	2.505	2.555
Baseflow	6.670	5.437	4.426	4.937	5.368
Total	17.51	11.81	7.121	10.97	11.85
Sediment Loss (t/a)	0.9900	0.2920	0.1140	0.3020	0.4245
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.6559	0.2761	0.1573	0.2470	0.3341
Interflow	7.511	8.706	3.786	6.433	6.609
Baseflow	2.065	1.544	2.202	5.419	2.807
Total	10.23	10.53	6.144	12.10	9.751
NH3 Loss					
Surface	2.754	0.9119	0.4055	0.8079	1.220
Interflow	0.8414	1.152	0.3974	1.183	0.8934
Baseflow	0.3297E-01	0.7259E-02	0.2811E-02	0.1952E-02	0.1125E-01
Sediment	0.1262E-01	0.3059E-02	0.1201E-02	0.3369E-02	0.5062E-02
Total	3.641	2.074	0.8070	1.997	2.130
ORGN Sediment	4.221	1.243	0.4838	1.282	1.807
Total N Loss (lb/a)	18.09	13.84	7.435	15.38	13.69
PO4 Loss					
Surface	1.061	0.6568	0.2362	0.5595	0.6284
Interflow	0.2108	0.3321	0.1781	0.4065	0.2819
Baseflow	0.5432E-03	0.4751E-06	0.3639E-06	0.7453E-06	0.1362E-03
Sediment	0.5288E-01	0.1542E-01	0.6099E-02	0.1727E-01	0.2292E-01
Total	1.325	1.004	0.4204	0.9833	0.9332
ORGP Sediment	1.138	0.3389	0.1305	0.3446	0.4880
Total P Loss (lb/a)	2.463	1.343	0.5510	1.328	1.421
Atm Depn. NO3 (lb/a)	6.464	6.154	5.854	6.257	6.182
Atm Depn. NH4 (lb/a)	2.118	1.894	1.670	1.964	1.911
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	88.79	88.92	87.86	90.61	89.04
Nitrate appln.(lb/a)	17.01	17.05	16.70	17.61	17.09
ORGN appln.(lb/a)	54.54	54.54	54.54	54.54	54.54
Total N appln.(lb/a)	160.3	160.5	159.1	162.8	160.7
PO4-P appln.(lb/a)	30.67	30.75	31.76	31.68	31.21
ORGP appln.(lb/a)	14.70	14.70	14.70	14.70	14.70
Total P appln.(lb/a)	45.37	45.45	46.46	46.38	45.91
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.4500E-01	0.2500E-01	0.7000E-02	0.2800E-01	0.2625E-01
Upper	89.89	92.26	92.26	92.15	91.64
Lower	33.35	41.27	39.32	60.99	43.73
Total	123.3	133.6	131.6	153.2	135.4
Phosphorus					
Surface	0.3400E-01	0.1900E-01	0.5000E-02	0.2100E-01	0.1975E-01
Upper	22.09	22.28	22.32	22.30	22.25
Lower	1.334	1.363	1.100	2.240	1.509
Total	23.46	23.67	23.43	24.55	23.78
Deficit (lb/a)					
Nitrogen					
Surface	1.506	1.526	1.544	1.523	1.525
Upper	2.860	0.4913	0.4754	0.5812	1.102
Lower	27.75	19.63	21.60	0.0000	17.24
Total	32.11	21.65	23.62	2.104	19.87
Phosphorus					
Surface	1.367	1.382	1.396	1.380	1.381
Upper	0.3326	0.1358	0.1021	0.1176	0.1720
Lower	2.870	2.839	3.102	1.962	2.693
Total	4.569	4.357	4.600	3.460	4.247
Other Fluxes-lb/ac					
N Mineralization	56.11	69.68	79.86	82.29	71.99
P Mineralization	1.924	2.084	1.906	2.217	2.033
Denitrification	1.879	2.015	3.365	7.839	3.774
N Immobilization	26.30	30.25	32.67	32.16	30.35
P Immobilization	5.328	8.441	6.636	10.32	7.681

AGCHEM Summary for Alternative No. 2 for the Shenandoah Basin (Low-Till), PERLND 203

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	28.82	38.09	39.88	28.66	33.86
Runoff (in)					
Surface	1.932	3.814	4.912	2.401	3.265
Interflow	1.441	2.476	2.906	1.419	2.060
Baseflow	4.146	5.137	5.669	4.391	4.836
Total	7.519	11.43	13.49	8.211	10.16
Sediment Loss (t/a)	0.1710	0.3710	0.6860	0.2850	0.3782
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.2456	0.3786	0.8641	0.3170	0.4513
Interflow	2.289	10.20	9.572	2.880	6.235
Baseflow	2.671	2.594	2.422	0.8129	2.125
Total	5.205	13.17	12.86	4.010	8.811
NH3 Loss					
Surface	0.6877	2.459	3.052	0.7373	1.734
Interflow	0.6644	0.9607	1.118	0.7110	0.8635
Baseflow	0.1226E-02	0.1069E-02	0.1024E-02	0.9976E-03	0.1079E-02
Sediment	0.2034E-02	0.4908E-02	0.8379E-02	0.4258E-02	0.4895E-02
Total	1.355	3.425	4.179	1.454	2.603
ORGN Sediment	0.7170	1.567	2.981	1.224	1.622
Total N Loss (lb/a)	7.278	18.16	20.02	6.688	13.04
PO4 Loss					
Surface	0.3653	0.9229	1.319	0.7561	0.8408
Interflow	0.1633	0.2889	0.3339	0.1841	0.2426
Baseflow	0.3018E-06	0.4595E-06	0.3959E-06	0.3341E-06	0.3728E-06
Sediment	0.9825E-02	0.2123E-01	0.3893E-01	0.1951E-01	0.2237E-01
Total	0.5384	1.233	1.692	0.9597	1.106
ORGP Sediment	0.1928	0.4249	0.8094	0.3281	0.4388
Total P Loss (lb/a)	0.7312	1.658	2.501	1.288	1.545
Atm Depn. NO3 (lb/a)	5.703	6.603	6.329	5.688	6.081
Atm Depn. NH4 (lb/a)	1.684	2.303	2.051	1.537	1.894
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	90.62	90.65	88.81	90.44	90.13
Nitrate appln.(lb/a)	17.62	17.63	17.02	17.56	17.46
ORGN appln.(lb/a)	54.54	54.54	54.54	54.54	54.54
Total N appln.(lb/a)	162.8	162.8	160.4	162.5	162.1
PO4-P appln.(lb/a)	31.72	31.76	30.83	31.76	31.52
ORGP appln.(lb/a)	14.70	14.70	14.70	14.70	14.70
Total P appln.(lb/a)	46.42	46.46	45.53	46.46	46.22
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.2100E-01	0.2500E-01	0.3100E-01	0.1000E-01	0.2175E-01
Upper	92.17	92.10	85.92	92.53	90.68
Lower	60.96	61.06	50.61	36.01	52.16
Total	153.2	153.2	136.6	128.6	142.9
Phosphorus					
Surface	0.1500E-01	0.1800E-01	0.1900E-01	0.7000E-02	0.1475E-01
Upper	22.30	22.28	22.33	22.35	22.32
Lower	1.402	1.624	1.215	0.9680	1.302
Total	23.72	23.92	23.56	23.33	23.63
Deficit (lb/a)					
Nitrogen					
Surface	1.530	1.526	1.520	1.540	1.529
Upper	0.6173	0.6610	6.803	0.2757	2.089
Lower	0.0000	0.0000	10.36	24.90	8.815
Total	2.148	2.187	18.68	26.72	12.43
Phosphorus					
Surface	1.386	1.383	1.381	1.394	1.386
Upper	0.1273	0.1322	0.9377E-01	0.6556E-01	0.1047
Lower	2.802	2.578	2.987	3.234	2.900
Total	4.315	4.093	4.462	4.694	4.391
Other Fluxes-lb/ac					
N Mineralization	82.20	91.41	54.54	76.50	76.16
P Mineralization	1.989	2.105	1.900	1.781	1.944
Denitrification	4.438	5.068	3.526	1.663	3.674
N Immobilization	32.94	35.36	25.91	32.74	31.74
P Immobilization	7.427	12.41	8.031	6.684	8.638

AGCHEM Summary for Alternative No. 2 for the Shenandoah Basin (HAY), PERLND 206

	1984	1985	1986	1987	SUM/AVER
Rainfall (in)	39.78	36.84	27.99	37.57	35.54
Runoff (in)					
Surface	6.998	3.215	1.060	2.775	3.512
Interflow	2.458	1.945	0.7600	1.580	1.686
Baseflow	6.566	5.063	4.028	4.531	5.047
Total	16.02	10.22	5.848	8.886	10.24
Sediment Loss (t/a)	0.7220	0.2190	0.6218E-01	0.1660	0.2923
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.4636	0.1517	0.9848E-01	0.1472	0.2152
Interflow	1.100	0.3814	0.4415	0.8085	0.6829
Baseflow	2.905	1.385	1.074	1.604	1.742
Total	4.469	1.918	1.614	2.560	2.640
NH3 Loss					
Surface	0.7725	0.1454	0.2059	0.2059	0.3324
Interflow	0.5704E-01	0.4189E-01	0.5666E-01	0.5688E-01	0.5312E-01
Baseflow	0.3273E-01	0.7040E-02	0.2679E-02	0.1830E-02	0.1107E-01
Sediment	0.7888E-02	0.2140E-02	0.6703E-03	0.1668E-02	0.3092E-02
Total	0.8702	0.1965	0.2659	0.2662	0.3997
ORGN Sediment	2.015	0.5972	0.1666	0.4434	0.8056
Total N Loss (lb/a)	7.354	2.712	2.046	3.270	3.846
PO4 Loss					
Surface	0.8015	0.1602	0.4143	0.3912	0.4418
Interflow	0.1561	0.1039	0.5274E-01	0.1647	0.1194
Baseflow	0.5453E-03	0.1553E-06	0.1319E-06	0.2898E-06	0.1365E-03
Sediment	0.3841E-01	0.1083E-01	0.3879E-02	0.8807E-02	0.1548E-01
Total	0.9965	0.2749	0.4709	0.5648	0.5768
ORGP Sediment	0.5457	0.1651	0.4549E-01	0.1197	0.2190
Total P Loss (lb/a)	1.542	0.4400	0.5164	0.6845	0.7957
Atm Depn. NO3 (lb/a)	6.464	6.154	5.854	6.257	6.182
Atm Depn. NH4 (lb/a)	2.118	1.894	1.670	1.964	1.911
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	26.11	26.11	26.11	26.11	26.11
Nitrate appln.(lb/a)	6.590	6.590	6.590	6.590	6.590
ORGN appln.(lb/a)	8.760	8.760	8.760	8.760	8.760
Total N appln.(lb/a)	41.46	41.46	41.46	41.46	41.46
PO4-p appln.(lb/a)	25.08	25.08	25.08	25.08	25.08
ORGP appln.(lb/a)	3.360	3.360	3.360	3.360	3.360
Total P appln.(lb/a)	28.44	28.44	28.44	28.44	28.44
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.1000E-01	0.4000E-02	0.1000E-02	0.6000E-02	0.5250E-02
Upper	32.56	35.39	34.23	32.28	33.61
Lower	12.84	12.84	12.84	12.84	12.84
Total	45.40	48.23	47.07	45.12	46.45
Phosphorus					
Surface	0.1600E-01	0.7000E-02	0.2000E-02	0.1000E-01	0.8750E-02
Upper	15.95	15.94	15.94	15.93	15.94
Lower	1.426	0.8360	0.8550	1.684	1.200
Total	17.39	16.78	16.80	17.62	17.15
Deficit (lb/a)					
Nitrogen					
Surface	0.4907	0.4966	0.4991	0.4941	0.4951
Upper	4.156	1.316	2.485	4.426	3.096
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	4.646	1.813	2.984	4.920	3.591
Phosphorus					
Surface	0.9846	0.9937	0.9984	0.9905	0.9918
Upper	0.7094E-01	0.7296E-01	0.7290E-01	0.8399E-01	0.7520E-01
Lower	1.576	2.165	2.146	1.318	1.801
Total	2.632	3.232	3.218	2.392	2.869
Other Fluxes-lb/ac					
N Mineralization	21.71	22.22	21.74	21.36	21.76
P Mineralization	1.783	1.761	1.581	1.857	1.745
Denitrification	4.110	2.940	2.899	3.727	3.419
N Immobilization	8.689	9.521	9.227	9.329	9.191
P Immobilization	9.639	9.899	6.976	11.55	9.516

AGCHEM Summary for Alternative No. 2 for the Shenandoah Basin (HAY), PERLND 206

	1988	1989	1990	1991	SUM/AVER
Rainfall (in)	28.82	38.09	39.88	28.66	33.86
Runoff (in)					
Surface	1.269	3.090	4.584	2.126	2.767
Interflow	0.8230	1.639	2.004	0.9720	1.359
Baseflow	3.928	4.760	5.488	4.383	4.640
Total	6.021	9.490	12.08	7.481	8.767
Sediment Loss (t/a)	0.7286E-01	0.1980	0.5660	0.2000	0.2592
Nutrient Loss (lb/a)					
NO3 Loss					
Surface	0.8987E-01	0.3364	0.1923	0.1885	0.2018
Interflow	0.2672	0.6050	0.6963	0.5548	0.5308
Baseflow	1.481	2.162	1.961	1.370	1.743
Total	1.839	3.103	2.850	2.113	2.476
NH3 Loss					
Surface	0.1151	0.5341	0.2630	0.2966	0.3022
Interflow	0.3032E-01	0.5279E-01	0.4426E-01	0.2834E-01	0.3893E-01
Baseflow	0.1141E-02	0.1151E-02	0.1180E-02	0.9205E-03	0.1098E-02
Sediment	0.7379E-03	0.2377E-02	0.5939E-02	0.2440E-02	0.2873E-02
Total	0.1473	0.5904	0.3143	0.3283	0.3451
ORGN Sediment	0.1916	0.5323	1.598	0.5520	0.7185
Total N Loss (lb/a)	2.177	4.226	4.762	2.994	3.540
PO4 Loss					
Surface	0.1807	0.7107	0.6222	0.7193	0.5582
Interflow	0.4059E-01	0.7540E-01	0.7230E-01	0.3700E-01	0.5632E-01
Baseflow	0.1160E-06	0.5811E-07	0.5335E-07	0.6895E-07	0.7410E-07
Sediment	0.3765E-02	0.1248E-01	0.3111E-01	0.1378E-01	0.1528E-01
Total	0.2251	0.7986	0.7256	0.7701	0.6299
ORGP Sediment	0.5157E-01	0.1458	0.4421	0.1477	0.1968
Total P Loss (lb/a)	0.2766	0.9445	1.168	0.9179	0.8268
Atm Depn. NO3 (lb/a)	5.703	6.603	6.329	5.688	6.081
Atm Depn. NH4 (lb/a)	1.684	2.303	2.051	1.537	1.894
Atm Depn. ORGN(lb/a)	0.6068	0.6070	0.6070	0.6070	0.6069
Atm Depn. PO4 (lb/a)	0.1427	0.1431	0.1431	0.1431	0.1430
Atm Depn. ORGP(lb/a)	0.0000	0.0000	0.0000	0.0000	0.0000
Ammonia appln.(lb/a)	26.11	25.66	25.45	25.64	25.71
Nitrate appln.(lb/a)	6.590	6.440	6.371	6.433	6.459
ORGN appln.(lb/a)	8.760	8.760	8.760	8.760	8.760
Total N appln.(lb/a)	41.46	40.86	40.58	40.83	40.93
PO4-p appln.(lb/a)	25.08	24.58	24.36	24.56	24.65
ORGP appln.(lb/a)	3.360	3.360	3.360	3.360	3.360
Total P appln.(lb/a)	28.44	27.94	27.72	27.92	28.01
Plant Uptake (lb/a)					
Nitrogen					
Surface	0.6000E-02	0.7000E-02	0.7000E-02	0.1000E-02	0.5250E-02
Upper	32.62	33.90	33.43	32.48	33.11
Lower	12.84	12.84	12.84	12.84	12.84
Total	45.46	46.74	46.27	45.32	45.95
Phosphorus					
Surface	0.1000E-01	0.1100E-01	0.1000E-01	0.3000E-02	0.8500E-02
Upper	15.93	15.92	15.95	15.97	15.94
Lower	0.9660	0.8310	0.7190	0.5790	0.7737
Total	16.90	16.76	16.68	16.55	16.72
Deficit (lb/a)					
Nitrogen					
Surface	0.4945	0.4937	0.4931	0.4990	0.4951
Upper	4.102	2.813	3.279	4.234	3.607
Lower	0.0000	0.0000	0.0000	0.0000	0.0000
Total	4.597	3.306	3.773	4.733	4.102
Phosphorus					
Surface	0.9908	0.9892	0.9901	0.9978	0.9920
Upper	0.9095E-01	0.9446E-01	0.6698E-01	0.4683E-01	0.7480E-01
Lower	2.036	2.171	2.282	2.423	2.228
Total	3.118	3.255	3.339	3.467	3.295
Other Fluxes-lb/ac					
N Mineralization	22.42	22.19	21.80	21.37	21.94
P Mineralization	1.570	1.679	1.616	1.455	1.580
Denitrification	4.186	4.773	3.961	3.551	4.118
N Immobilization	9.683	9.492	9.310	9.113	9.399
P Immobilization	9.092	10.62	8.743	5.982	8.609

Per Acre Load Contributed from Each Land Use in Shenandoah Basin for Alternative No. 1 (lb/ac)

Segment 190

	Pervious						Impervious		Total
	FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Load
NH3									
84	0.07395	0.0	2.588	0.122	0.518	0.9464	259.1135	1.08	0.531086
85	0.05978	0.0	1.509	0.09196	0.492	0.3902	253.8161	0.969	0.365575
86	0.03314	0.0	0.3092	0.04404	0.126	0.1995	143.745	1.02	0.16135
87	0.05784	0.0	2.008	0.08217	0.387	0.3459	255.5246	1.05	0.388635
88	0.03436	0.0	0.842	0.04569	0.09389	0.1492	160.2792	0.992	0.199187
89	0.06837	0.0	1.706	0.09252	0.33	1.52	256.1574	1.13	0.512235
90	0.06026	0.0	2.215	0.08365	0.371	0.4733	233.8467	1.07	0.411028
91	0.05155	0.0	0.9131	0.07117	0.248	0.5291	194.4052	1.02	0.28938
MEAN	0.054906	0.0	1.511287	0.07915	0.320736	0.5692	219.611	1.041375	0.35731
NO3									
84	1.48	0.0	12.4	6.12	7.65	4.838	64.77838	2.38	4.182106
85	1.53	0.0	8.568001	5.54	6.76	2.838	63.45402	2.13	3.490686
86	0.862	0.0	2.106	3.07	3.29	1.774	35.93626	2.23	1.76155
87	1.26	0.0	6.405	4.86	6.04	3.447	63.88116	2.32	3.075145
88	0.847	0.0	2.692	3.28	3.49	2.089	40.0698	2.18	1.895582
89	1.37	0.0	13.72	5.78	6.87	4.132	64.03936	2.47	4.011399
90	1.43	0.0	11.21	5.29	6.33	3.344	58.46167	2.35	3.612426
91	1.21	0.0	3.71	4.26	4.92	2.836	48.6013	2.25	2.56087
MEAN	1.248625	0.0	7.601376	4.775	5.668751	3.16225	54.90275	2.28875	3.073721
ORGN									
84	0.64183	0.0	4.233	1.63611	3.5616	2.117	1554.681	3.39836	2.19673
85	0.44149	0.0	7.403	1.113	3.45401	2.099	1522.896	3.06446	2.185583
86	0.139496	0.0	0.7436	0.42294	0.66038	0.3051	862.4703	3.21286	0.717579
87	0.39326	0.0	4.478	0.94976	2.62297	1.894	1533.148	3.33529	1.837568
88	0.104251	0.0	0.3091	0.40439	0.359499	0.07136	961.6753	3.13495	0.653451
89	0.45633	0.0	2.155	0.99799	2.03679	1.063	1536.945	3.55789	1.574098
90	0.368032	0.0	3.413	0.91266	2.44118	1.724	1403.08	3.37239	1.653506
91	0.322399	0.0	2.34	0.8162	1.52852	0.6977	1166.431	3.23883	1.244273
MEAN	0.358386	0.0	3.134337	0.906631	2.083118	1.246395	1317.666	3.289379	1.507848
TN									
84	2.19578	0.0	19.22	7.87811	11.7296	7.901	2267.243	6.85836	7.067747
85	2.03127	0.0	17.48	6.74496	10.70601	5.327	2220.891	6.16346	6.196538
86	1.034636	0.0	3.159	3.53698	4.07638	2.279	1257.769	6.46286	2.728163
87	1.7111	0.0	12.89	5.89193	9.04997	5.687	2235.841	6.70529	5.457047
88	0.985611	0.0	3.843	3.73008	3.943389	2.309	1402.443	6.30695	2.845847
89	1.8947	0.0	17.58	6.87051	9.236791	6.715	2241.378	7.15789	6.253805
90	1.858292	0.0	16.84	6.28631	9.14218	5.542	2046.159	6.79239	5.819736
91	1.583949	0.0	6.962	5.14737	6.69652	4.063	1701.045	6.50883	4.21297
MEAN	1.661917	0.0	12.24675	5.760781	8.072605	4.977875	1921.596	6.619503	5.072731
PO4									
84	0.05055	0.0	0.6844	0.0749	0.471	1.412	64.77838	0.481	0.330475
85	0.02645	0.0	0.9433	0.05413	0.461	0.6446	63.45402	0.433	0.238943
86	0.00938	0.0	0.3117	0.02004	0.07753	0.4232	35.93626	0.454	0.112129
87	0.02937	0.0	0.8734	0.04623	0.346	0.8595	63.88116	0.471	0.25199
88	0.005542	0.0	0.3087	0.01921	0.03386	0.2234	40.0698	0.443	0.084265
89	0.03351	0.0	1.392	0.04997	0.261	1.547	64.03936	0.503	0.369734
90	0.02245	0.0	1.362	0.04503	0.319	0.8742	58.46167	0.477	0.281858
91	0.02436	0.0	0.8002	0.03794	0.194	1.135	48.6013	0.458	0.257931
MEAN	0.025202	0.0	0.834463	0.043431	0.270424	0.889863	54.90275	0.465	0.240916
ORGP									
84	0.09169	0.0	1.126	0.23373	0.5088	0.5689	259.1135	0.48548	0.398927
85	0.06307	0.0	1.98	0.159	0.49343	0.5838	253.8161	0.43778	0.428514
86	0.019928	0.0	0.1987	0.06042	0.09434	0.08416	143.745	0.45898	0.122485
87	0.05618	0.0	1.188	0.13568	0.37471	0.5153	255.5246	0.47647	0.346789
88	0.014893	0.0	0.08236	0.05777	0.051357	0.01911	160.2792	0.44785	0.106521
89	0.06519	0.0	0.5745	0.14257	0.29097	0.2934	256.1574	0.50827	0.276208
90	0.052576	0.0	0.9141	0.13038	0.34874	0.4769	233.8467	0.48177	0.308625
91	0.046057	0.0	0.6252	0.1166	0.21836	0.1897	194.4052	0.46269	0.221124
MEAN	0.051198	0.0	0.836107	0.129519	0.297588	0.341409	219.611	0.469911	0.276149

Segment 190

	Pervious FOR	HTC	LTC	PAS	URB	HAY	Impervious ANML	RES	Total Load
TP									
84	0.14224	0.0	1.811	0.30863	0.9798	1.981	453.4486	0.96648	0.782107
85	0.08952	0.0	2.924	0.21313	0.95443	1.228	444.1781	0.87078	0.719034
86	0.029308	0.0	0.5103	0.08046	0.17187	0.5073	251.5538	0.91298	0.263806
87	0.08555	0.0	2.061	0.18191	0.72071	1.375	447.1681	0.94747	0.650693
88	0.020435	0.0	0.3911	0.07698	0.085217	0.2426	280.4886	0.89085	0.223366
89	0.0987	0.0	1.967	0.19254	0.55197	1.84	448.2755	1.01127	0.69798
90	0.075026	0.0	2.276	0.17541	0.66774	1.351	409.2317	0.95877	0.637978
91	0.070417	0.0	1.425	0.15454	0.41236	1.325	340.2091	0.92069	0.518563
MEAN	0.076399	0.0	1.670675	0.17295	0.568012	1.231237	384.3192	0.934911	0.561691
BOD									
84	5.19	0.0	65.10001	13.23	28.8	39.9	4534.486	27.48	19.48365
85	3.57	0.0	142.2	9.0	27.93	40.5	4441.781	24.78	23.32123
86	1.128	0.0	11.46	3.42	5.34	6.210001	2515.538	25.98	4.837374
87	3.18	0.0	79.8	7.68	21.21	36.9	4471.681	26.97	17.41364
88	0.843	0.0	8.820001	3.27	2.907	2.466	2804.886	25.35	3.952744
89	3.69	0.0	46.2	8.070001	16.47	21.99	4482.755	28.77	13.21006
90	2.976	0.0	68.10001	7.380001	19.74	33.6	4092.317	27.27	15.74198
91	2.607	0.0	38.7	6.6	12.36	13.95	3402.091	26.19	10.05395
MEAN	2.898	0.0	57.5475	7.33125	16.84463	24.4395	3843.192	26.59875	13.50183
SED									
84	0.161	0.0	1.01	0.377	0.291	0.764	0.0	0.0	0.34842
85	0.07501	0.0	1.72	0.247	0.285	0.751	0.0	0.0	0.327416
86	0.03091	0.0	0.175	0.0886	0.04231	0.111	0.0	0.0	0.06382
87	0.07149	0.0	1.05	0.208	0.211	0.682	0.0	0.0	0.254502
88	0.01559	0.0	0.07836	0.08145	0.01251	0.03172	0.0	0.0	0.035972
89	0.08934	0.0	0.517	0.213	0.149	0.391	0.0	0.0	0.186156
90	0.06207	0.0	0.806	0.197	0.191	0.619	0.0	0.0	0.220583
91	0.06088	0.0	0.553	0.18	0.115	0.255	0.0	0.0	0.14878
MEAN	0.070786	0.0	0.73867	0.199006	0.162103	0.45059	0.0	0.0	0.198206

Segment 200

	<----------Pervious----------						><----Impervious---->		Total
	FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Load
NH3									
84	0.05779	0.0	2.408	0.118	0.57	0.7735	228.8566	1.38	0.418653
85	0.04321	0.0	0.8725	0.06504	0.206	0.1686	203.4	1.28	0.207493
86	0.02965	0.0	0.311	0.0435	0.13	0.2719	127.8527	1.32	0.141934
87	0.03721	0.0	1.323	0.06537	0.211	0.2046	212.675	1.37	0.241692
88	0.02937	0.0	1.008	0.0371	0.121	0.1293	141.7562	1.26	0.17328
89	0.03945	0.0	1.187	0.06877	0.232	0.4415	194.6222	1.45	0.256134
90	0.04685	0.0	1.813	0.08391	0.293	0.2706	222.158	1.41	0.297538
91	0.03502	0.0	0.6016	0.04402	0.119	0.3338	135.7537	1.33	0.172168
MEAN	0.039819	0.0	1.190512	0.065714	0.23525	0.324225	183.3843	1.35	0.238612
NO3									
84	1.3	0.0	10.85	5.81	7.45	4.548	57.21416	2.54	3.683308
85	1.19	0.0	6.266	4.55	4.81	1.918	50.85	2.35	2.612641
86	0.78	0.0	1.652	2.99	3.22	1.618	31.96318	2.41	1.61008
87	0.874	0.0	5.612	3.8	4.3	2.453	53.16876	2.5	2.258544
88	0.688	0.0	3.09	2.83	3.2	1.753	35.43906	2.3	1.62869
89	0.838	0.0	4.633	3.96	4.65	2.999	48.65554	2.65	2.291029
90	1.15	0.0	10.48	4.81	5.47	2.843	55.5395	2.58	3.060379
91	0.943	0.0	1.447	3.31	3.48	2.151	33.93842	2.44	1.829224
MEAN	0.970375	0.0	5.50375	4.0075	4.5725	2.535375	45.84608	2.47125	2.371737
ORGN									
84	0.52311	0.0	4.153	1.60272	4.0439	2.003	1373.14	3.31674	1.841032
85	0.228165	0.0	1.215	0.65296	1.19091	0.5889	1220.4	3.07188	0.919786
86	0.111671	0.0	0.4714	0.41923	0.7049	0.1654	767.1164	3.16092	0.538692
87	0.188097	0.0	1.257	0.76055	1.2985	0.4412	1276.05	3.27593	0.938186
88	0.116865	0.0	0.7038	0.280476	0.64183	0.1905	850.5375	3.01252	0.547838
89	0.267862	0.0	1.544	0.80507	1.45061	0.5277	1167.733	3.47256	0.993755
90	0.335384	0.0	2.932	1.01654	1.87355	1.572	1332.948	3.37239	1.352738
91	0.089782	0.0	1.199	0.365806	0.58247	0.5521	814.5221	3.1906	0.611154
MEAN	0.232617	0.0	1.6844	0.737919	1.473334	0.7551	1100.306	3.234192	0.967897
TN									
84	1.8809	0.0	17.41	7.53072	12.0639	7.324	2002.496	7.23674	6.054855
85	1.461375	0.0	8.354	5.268	6.20691	2.675	1779.75	6.70188	3.839422
86	0.921321	0.0	2.434	3.45273	4.0549	2.055	1118.711	6.89092	2.353207
87	1.099307	0.0	8.193001	4.62592	5.8095	3.099	1860.907	7.14593	3.54257
88	0.834235	0.0	4.802	3.147576	3.96283	2.073	1240.367	6.57252	2.419203
89	1.145312	0.0	7.364	4.83384	6.33261	3.968	1702.944	7.572559	3.636125
90	1.532234	0.0	15.22	5.91045	7.63655	4.686	1943.882	7.36239	4.819077
91	1.067802	0.0	3.247	3.719826	4.18147	3.037	1187.845	6.9606	2.678942
MEAN	1.242811	0.0	8.378	4.811133	6.281084	3.614625	1604.613	7.055442	3.667925
PO4									
84	0.01275	0.0	0.6164	0.07378	0.545	1.029	57.21416	0.472	0.225821
85	0.004142	0.0	0.7467	0.03355	0.15	0.2637	50.85	0.437	0.116499
86	0.002498	0.0	0.2151	0.01954	0.08389	0.5141	31.96318	0.449	0.094931
87	0.003925	0.0	0.5577	0.0365	0.167	0.5433	53.16876	0.466	0.136311
88	0.002625	0.0	0.3482	0.01425	0.07615	0.2152	35.43906	0.428	0.0714
89	0.006005	0.0	0.6788	0.03844	0.187	0.7634	48.65554	0.494	0.168686
90	0.007046	0.0	1.198	0.04843	0.244	0.7023	55.5395	0.479	0.203578
91	0.001943	0.0	0.3832	0.01823	0.06614	0.8423	33.93842	0.454	0.139281
MEAN	0.005117	0.0	0.593013	0.03534	0.189898	0.609163	45.84608	0.459875	0.144563
ORGP									
84	0.07473	0.0	1.108	0.22896	0.5777	0.5406	228.8566	0.47382	0.333374
85	0.032595	0.0	0.3241	0.09328	0.17013	0.1617	203.4	0.43884	0.158668
86	0.015953	0.0	0.1257	0.05989	0.1007	0.04507	127.8527	0.45156	0.088907
87	0.026871	0.0	0.3351	0.10865	0.1855	0.1188	212.675	0.46799	0.159766
88	0.016695	0.0	0.1875	0.040068	0.09169	0.05113	141.7562	0.43036	0.092957
89	0.038266	0.0	0.4118	0.11501	0.20723	0.144	194.6222	0.49608	0.1705
90	0.047912	0.0	0.7789	0.14522	0.26765	0.4317	222.158	0.48177	0.248416
91	0.012826	0.0	0.3197	0.052258	0.08321	0.1478	135.7537	0.4558	0.110384
MEAN	0.033231	0.0	0.44885	0.105417	0.210476	0.2051	183.3843	0.462027	0.170371

Segment 200

	FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Total Load
	<----------	----------	----------	Pervious	----------	---------->	<----Impervious	---->	
TP									
84	0.08748	0.0	1.724	0.30274	1.1227	1.57	400.4991	0.94582	0.596537
85	0.036737	0.0	1.071	0.12683	0.32013	0.4254	355.95	0.87584	0.308353
86	0.018451	0.0	0.3407	0.07943	0.18459	0.5592	223.7423	0.90056	0.204687
87	0.030796	0.0	0.8929	0.14515	0.3525	0.6621	372.1813	0.93399	0.33077
88	0.01932	0.0	0.5357	0.054318	0.16784	0.2663	248.0734	0.85836	0.187475
89	0.044271	0.0	1.091	0.15345	0.39423	0.9074	340.5888	0.99008	0.370954
90	0.054958	0.0	1.977	0.19365	0.51165	1.134	388.7765	0.96077	0.488234
91	0.014769	0.0	0.7029	0.070488	0.14935	0.9901	237.5689	0.9098	0.271806
MEAN	0.038348	0.0	1.0419	0.140757	0.400374	0.814312	320.9225	0.921903	0.344852
BOD									
84	4.23	0.0	59.1	12.96	32.7	51.9	4004.991	26.82	17.95011
85	1.845	0.0	22.77	5.28	9.63	18.84	3559.5	24.84	7.685593
86	0.903	0.0	7.68	3.39	5.7	3.99	2237.423	25.56	3.588633
87	1.521	0.0	19.95	6.15	10.5	12.12	3721.813	26.49	6.958815
88	0.945	0.0	13.47	2.268	5.19	6.57	2480.734	24.36	4.022025
89	2.166	0.0	28.23	6.510001	11.73	18.12	3405.888	28.08	8.528705
90	2.712	0.0	50.1	8.22	15.15	50.7	3887.765	27.27	14.36487
91	0.726	0.0	14.73	2.958	4.71	11.31	2375.689	25.8	4.608787
MEAN	1.881	0.0	27.00375	5.967	11.91375	21.69375	3209.225	26.1525	8.463443
SED									
84	0.15	0.0	0.99	0.351	0.524	0.722	0.0	0.0	0.329046
85	0.03882	0.0	0.292	0.129	0.125	0.219	0.0	0.0	0.099306
86	0.02627	0.0	0.114	0.0828	0.07266	0.06218	0.0	0.0	0.051127
87	0.03697	0.0	0.302	0.159	0.147	0.166	0.0	0.0	0.101694
88	0.02868	0.0	0.171	0.04936	0.06394	0.07286	0.0	0.0	0.048788
89	0.0604	0.0	0.371	0.168	0.167	0.198	0.0	0.0	0.125002
90	0.06652	0.0	0.686	0.215	0.221	0.566	0.0	0.0	0.200992
91	0.01242	0.0	0.285	0.06751	0.05166	0.2	0.0	0.0	0.064519
MEAN	0.05251	0.0	0.401375	0.152709	0.171532	0.275755	0.0	0.0	0.127559

Percent of Total Load Contributed from Each Land Use in Shenandoah Basin for Alternative No. 1

Segment 190

		<-----Pervious					---><----Impervious-->		Point	Total
		FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Source	Load
NH3											
	84	2.02	0.00	10.46	1.47	2.04	6.24	5.81	1.25	70.73	100.00
	85	2.02	0.00	7.52	1.37	2.39	3.17	7.02	1.38	75.11	100.00
	86	1.28	0.00	1.77	0.75	0.70	1.86	4.55	1.66	87.44	100.00
	87	1.76	0.00	9.04	1.10	1.70	2.54	6.38	1.35	76.11	100.00
	88	1.16	0.00	4.19	0.68	0.46	1.21	4.42	1.41	86.50	100.00
	89	2.29	0.00	8.44	1.37	1.59	12.27	7.02	1.60	65.41	100.00
	90	2.16	0.00	11.76	1.33	1.92	4.10	6.88	1.62	70.21	100.00
	91	2.13	0.00	5.58	1.30	1.48	5.27	6.58	1.78	75.85	100.00
MEAN		1.86	0.00	7.55	1.18	1.56	4.64	6.09	1.49	75.64	100.00
NO3											
	84	17.13	0.00	21.22	31.27	12.76	13.51	0.61	1.16	2.33	100.00
	85	21.19	0.00	17.54	33.85	13.49	9.48	0.72	1.25	2.48	100.00
	86	23.25	0.00	8.40	36.54	12.79	11.54	0.79	2.54	4.13	100.00
	87	19.70	0.00	14.81	33.54	13.62	13.01	0.82	1.53	2.95	100.00
	88	21.27	0.00	10.00	36.35	12.63	12.66	0.82	2.31	3.97	100.00
	89	16.60	0.00	24.59	30.91	12.00	12.08	0.64	1.26	1.94	100.00
	90	19.19	0.00	22.25	31.35	12.25	10.83	0.64	1.33	2.15	100.00
	91	22.72	0.00	10.30	35.31	13.32	12.85	0.75	1.79	2.96	100.00
MEAN		19.60	0.00	17.64	33.08	12.82	11.97	0.71	1.52	2.67	100.00
ORGN											
	84	13.58	0.00	13.25	15.28	10.87	10.81	26.98	3.04	6.20	100.00
	85	9.45	0.00	23.44	10.52	10.66	10.84	26.73	2.77	5.58	100.00
	86	8.35	0.00	6.58	11.18	5.70	4.41	42.34	8.13	13.32	100.00
	87	9.87	0.00	16.63	10.52	9.49	11.47	31.56	3.54	6.89	100.00
	88	6.52	0.00	2.86	11.16	3.24	1.08	49.31	8.28	17.56	100.00
	89	13.19	0.00	9.21	12.73	8.48	7.41	36.42	4.34	8.23	100.00
	90	10.17	0.00	13.94	11.12	9.72	11.49	31.78	3.94	7.86	100.00
	91	11.55	0.00	12.40	12.91	7.89	6.03	34.27	4.90	10.02	100.00
MEAN		10.81	0.00	13.98	12.07	9.06	9.07	32.59	4.19	8.22	100.00
TN											
	84	12.66	0.00	16.38	20.04	9.75	10.99	10.72	1.67	17.78	100.00
	85	13.39	0.00	17.04	19.62	10.17	8.47	12.00	1.72	17.59	100.00
	86	12.70	0.00	5.73	19.17	7.21	6.75	12.66	3.35	32.42	100.00
	87	12.25	0.00	13.64	18.61	9.34	9.82	13.12	2.03	21.21	100.00
	88	11.26	0.00	6.49	18.81	6.49	6.36	13.14	3.04	34.38	100.00
	89	12.62	0.00	17.31	20.19	8.87	10.79	12.24	2.01	15.99	100.00
	90	13.14	0.00	17.61	19.62	9.32	9.45	11.86	2.03	16.98	100.00
	91	14.70	0.00	9.56	21.08	8.96	9.10	12.94	2.55	21.10	100.00
MEAN		12.87	0.00	14.02	19.68	9.01	9.30	12.20	2.17	20.75	100.00
PO4											
	84	3.70	0.00	7.41	2.42	4.97	24.95	3.89	1.49	51.16	100.00
	85	2.36	0.00	12.43	2.13	5.92	13.86	4.63	1.63	57.05	100.00
	86	1.16	0.00	5.72	1.10	1.39	12.67	3.66	2.38	71.91	100.00
	87	2.48	0.00	10.90	1.72	4.21	17.51	4.42	1.68	57.06	100.00
	88	0.75	0.00	6.18	1.15	0.66	7.30	4.45	2.54	77.00	100.00
	89	3.02	0.00	18.54	1.99	3.39	33.60	4.73	1.91	32.83	100.00
	90	2.41	0.00	21.58	2.13	4.93	22.60	5.14	2.16	39.07	100.00
	91	2.69	0.00	13.04	1.85	3.08	30.18	4.39	2.13	42.64	100.00
MEAN		2.47	0.00	12.09	1.88	3.82	21.02	4.41	1.92	52.38	100.00
ORGP											
	84	9.88	0.00	17.94	11.11	7.90	14.79	22.89	2.21	13.28	100.00
	85	6.45	0.00	29.94	7.18	7.27	14.41	21.29	1.89	11.56	100.00
	86	5.70	0.00	8.41	7.63	3.89	5.81	33.73	5.55	29.26	100.00
	87	6.86	0.00	21.45	7.31	6.59	15.18	25.59	2.46	14.56	100.00
	88	4.36	0.00	3.56	7.46	2.17	1.35	38.45	5.54	37.09	100.00
	89	10.30	0.00	13.43	9.94	6.63	11.18	33.18	3.39	11.94	100.00
	90	7.53	0.00	19.36	8.24	7.20	16.48	27.46	2.91	10.82	100.00
	91	8.77	0.00	17.59	9.79	5.99	8.71	30.33	3.72	15.09	100.00
MEAN		7.77	0.00	18.76	8.67	6.51	12.50	27.32	3.01	15.46	100.00

Segment 190

		FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Point Source	Total Load
		<--------	--------	--------	Pervious	--------	-------->	<----Impervious	-->		
TP											
	84	5.93	0.00	11.16	5.68	5.89	19.92	15.50	1.70	34.25	100.00
	85	4.06	0.00	19.61	4.27	6.24	13.44	16.52	1.67	34.17	100.00
	86	2.41	0.00	6.22	2.93	2.04	10.08	16.99	3.18	56.15	100.00
	87	4.06	0.00	14.46	3.81	4.93	15.74	17.40	1.90	37.73	100.00
	88	1.78	0.00	5.05	2.96	1.07	5.11	20.07	3.29	60.67	100.00
	89	5.34	0.00	15.73	4.60	4.30	24.01	19.88	2.31	23.81	100.00
	90	4.34	0.00	19.48	4.48	5.57	18.87	19.43	2.35	25.48	100.00
	91	4.66	0.00	13.93	4.51	3.93	21.13	18.44	2.57	30.81	100.00
MEAN		4.32	0.00	13.95	4.31	4.63	16.78	17.80	2.23	35.97	100.00
BOD											
	84	12.28	0.00	22.78	13.82	9.82	22.78	8.80	2.75	6.98	100.00
	85	7.23	0.00	42.62	8.05	8.16	19.80	7.38	2.12	4.64	100.00
	86	9.28	0.00	13.94	12.42	6.33	12.33	16.97	9.03	19.70	100.00
	87	8.32	0.00	30.88	8.87	8.00	23.30	9.60	2.98	8.05	100.00
	88	7.61	0.00	11.78	13.03	3.78	5.37	20.77	9.67	27.97	100.00
	89	12.41	0.00	22.97	11.98	7.98	17.84	12.36	4.09	10.38	100.00
	90	8.54	0.00	28.90	9.35	8.17	23.26	9.63	3.31	8.86	100.00
	91	11.16	0.00	24.48	12.47	7.62	14.40	11.93	4.74	13.21	100.00
MEAN		9.62	0.00	28.24	10.74	8.06	19.57	10.46	3.73	9.57	100.00
SED											
	84	22.90	0.00	21.24	23.66	5.97	26.22	0.00	0.00	0.00	100.00
	85	11.35	0.00	38.50	16.50	6.22	27.43	0.00	0.00	0.00	100.00
	86	24.00	0.00	20.10	30.37	4.74	20.80	0.00	0.00	0.00	100.00
	87	13.92	0.00	30.23	17.88	5.92	32.04	0.00	0.00	0.00	100.00
	88	21.48	0.00	15.96	49.53	2.48	10.54	0.00	0.00	0.00	100.00
	89	23.78	0.00	20.35	25.02	5.72	25.11	0.00	0.00	0.00	100.00
	90	13.95	0.00	26.78	19.54	6.19	33.56	0.00	0.00	0.00	100.00
	91	20.29	0.00	27.25	26.47	5.52	20.50	0.00	0.00	0.00	100.00
MEAN		17.70	0.00	27.32	21.97	5.85	27.19	0.00	0.00	0.00	100.00

Segment 200

		FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Point Source	Total Load
		<----------	----------	----------	Pervious	----------	---------->	<----Impervious	-->		
NH3											
	84	2.06	0.00	10.48	1.89	2.04	5.49	5.06	1.35	71.65	100.00
	85	1.77	0.00	4.35	1.20	0.85	1.37	5.15	1.43	83.90	100.00
	86	1.33	0.00	1.70	0.88	0.59	2.43	3.56	1.62	87.86	100.00
	87	1.53	0.00	6.62	1.21	0.87	1.67	5.41	1.54	81.18	100.00
	88	1.22	0.00	5.12	0.70	0.51	1.07	3.66	1.43	86.26	100.00
	89	2.55	0.00	9.34	2.00	1.50	5.67	7.78	2.56	68.60	100.00
	90	2.88	0.00	13.58	2.32	1.81	3.31	8.45	2.37	65.29	100.00
	91	2.41	0.00	5.06	1.37	0.82	4.58	5.80	2.51	77.44	100.00
MEAN		1.88	0.00	6.86	1.40	1.12	3.05	5.37	1.74	78.60	100.00
NO3											
	84	18.43	0.00	18.75	37.08	10.60	12.83	0.50	0.98	0.85	100.00
	85	23.68	0.00	15.21	40.76	9.61	7.60	0.63	1.28	1.22	100.00
	86	25.06	0.00	6.47	43.24	10.38	10.34	0.64	2.12	1.77	100.00
	87	20.09	0.00	15.73	39.33	9.92	11.22	0.76	1.57	1.35	100.00
	88	21.87	0.00	11.98	40.49	10.21	11.09	0.70	2.00	1.68	100.00
	89	19.03	0.00	12.83	40.49	10.60	13.55	0.68	1.64	1.16	100.00
	90	19.61	0.00	21.79	36.90	9.36	9.65	0.59	1.20	0.87	100.00
	91	26.75	0.00	5.01	42.28	9.91	12.14	0.60	1.89	1.39	100.00
MEAN		21.28	0.00	14.72	39.56	10.07	11.07	0.62	1.48	1.20	100.00
ORGN											
	84	14.70	0.00	14.23	20.27	11.41	11.20	23.91	2.55	1.72	100.00
	85	12.60	0.00	8.19	16.23	6.60	6.47	41.78	4.64	3.49	100.00
	86	10.36	0.00	5.33	17.51	6.57	3.05	44.11	8.01	5.03	100.00
	87	10.21	0.00	8.32	18.58	7.08	4.77	42.93	4.86	3.25	100.00
	88	10.62	0.00	7.80	11.47	5.85	3.44	47.89	7.48	5.46	100.00
	89	13.77	0.00	9.68	18.64	7.49	5.40	37.21	4.88	2.94	100.00
	90	12.77	0.00	13.61	17.42	7.16	11.91	31.44	3.51	2.17	100.00
	91	7.39	0.00	12.04	13.56	4.81	9.05	41.56	7.18	4.39	100.00
MEAN		12.26	0.00	10.83	17.51	7.80	7.92	35.94	4.66	3.07	100.00
TN											
	84	13.80	0.00	15.58	24.88	8.88	10.69	9.10	1.45	15.63	100.00
	85	15.43	0.00	10.76	25.05	6.58	5.62	11.64	1.93	22.99	100.00
	86	14.10	0.00	4.54	23.78	6.23	6.26	10.61	2.88	31.60	100.00
	87	12.46	0.00	11.32	23.60	6.61	6.99	13.07	2.21	23.76	100.00
	88	12.31	0.00	8.64	20.90	5.87	6.08	11.34	2.65	32.24	100.00
	89	14.18	0.00	11.12	26.92	7.87	9.77	13.06	2.56	14.50	100.00
	90	14.84	0.00	17.98	25.77	7.42	9.03	11.66	1.95	11.35	100.00
	91	16.91	0.00	6.27	26.52	6.65	9.57	11.66	3.01	19.41	100.00
MEAN		14.21	0.00	11.68	24.78	7.21	8.23	11.37	2.20	20.33	100.00
PO4											
	84	1.92	0.00	11.30	4.99	8.22	30.77	5.33	1.94	35.55	100.00
	85	0.90	0.00	19.77	3.28	3.27	11.39	6.84	2.59	51.96	100.00
	86	0.62	0.00	6.51	2.18	2.09	25.40	4.92	3.05	55.22	100.00
	87	0.79	0.00	13.62	3.29	3.36	21.64	6.60	2.55	48.13	100.00
	88	0.69	0.00	11.12	1.68	2.00	11.22	5.75	3.06	64.48	100.00
	89	1.19	0.00	16.42	3.43	3.72	30.13	5.98	2.68	36.43	100.00
	90	1.24	0.00	25.62	3.82	4.29	24.50	6.03	2.29	32.20	100.00
	91	0.41	0.00	9.96	1.75	1.42	35.74	4.48	2.65	43.58	100.00
MEAN		1.04	0.00	14.63	3.22	3.86	24.53	5.75	2.54	44.44	100.00
ORGP											
	84	11.07	0.00	20.02	15.27	8.59	15.94	21.01	1.92	6.19	100.00
	85	9.49	0.00	11.51	12.22	4.97	9.36	36.68	3.49	12.30	100.00
	86	7.67	0.00	7.37	12.96	4.86	4.31	38.06	5.93	18.86	100.00
	87	7.77	0.00	11.82	14.14	5.38	6.83	38.10	3.70	12.27	100.00
	88	7.42	0.00	10.17	8.02	4.09	4.52	39.05	5.23	21.52	100.00
	89	10.68	0.00	14.02	14.45	5.81	8.00	33.67	3.78	9.56	100.00
	90	9.47	0.00	18.77	12.92	5.31	16.97	27.20	2.60	6.77	100.00
	91	5.18	0.00	15.75	9.51	3.38	11.89	34.00	5.03	15.26	100.00
MEAN		9.14	0.00	15.05	13.05	5.81	11.22	31.24	3.47	11.01	100.00

Segment 200

		Pervious						Impervious		Point	Total
		FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Source	Load
TP											
	84	6.20	0.00	14.90	9.66	7.98	22.13	17.57	1.83	19.72	100.00
	85	4.23	0.00	15.06	6.58	3.70	9.76	25.42	2.76	32.46	100.00
	86	2.84	0.00	6.39	5.50	2.85	17.11	21.31	3.78	40.23	100.00
	87	3.38	0.00	11.95	7.17	3.88	14.46	25.31	2.80	31.04	100.00
	88	2.97	0.00	10.04	3.76	2.59	8.14	23.63	3.60	45.27	100.00
	89	4.80	0.00	14.42	7.49	4.29	19.57	22.87	2.93	23.62	100.00
	90	4.80	0.00	21.05	7.61	4.48	19.70	21.03	2.29	19.03	100.00
	91	1.95	0.00	11.30	4.18	1.98	25.98	19.41	3.28	31.93	100.00
MEAN		4.19	0.00	13.89	6.93	4.39	17.72	21.74	2.75	28.38	100.00
BOD											
	84	11.74	0.00	20.01	16.19	9.11	28.66	6.88	2.03	5.38	100.00
	85	11.60	0.00	17.46	14.94	6.08	23.58	13.86	4.27	8.21	100.00
	86	10.69	0.00	11.09	18.07	6.77	9.40	16.41	8.27	19.29	100.00
	87	9.75	0.00	15.61	17.76	6.76	15.47	14.79	4.64	15.25	100.00
	88	9.42	0.00	16.38	10.18	5.19	13.03	15.32	6.64	23.84	100.00
	89	11.66	0.00	18.53	15.77	6.33	19.40	11.35	4.13	12.83	100.00
	90	9.14	0.00	20.59	12.47	5.13	34.01	8.12	2.51	8.04	100.00
	91	6.52	0.00	16.13	11.95	4.24	20.21	13.21	6.33	21.41	100.00
MEAN		10.35	0.00	18.12	14.78	6.58	23.75	10.94	3.93	11.55	100.00
SED											
	84	24.00	0.00	19.32	25.28	8.42	22.99	0.00	0.00	0.00	100.00
	85	20.59	0.00	18.88	30.79	6.65	23.11	0.00	0.00	0.00	100.00
	86	27.05	0.00	14.32	38.39	7.51	12.74	0.00	0.00	0.00	100.00
	87	19.14	0.00	19.07	37.05	7.64	17.10	0.00	0.00	0.00	100.00
	88	30.96	0.00	22.51	23.98	6.93	15.65	0.00	0.00	0.00	100.00
	89	25.44	0.00	19.05	31.85	7.06	16.60	0.00	0.00	0.00	100.00
	90	17.43	0.00	21.92	25.35	5.81	29.51	0.00	0.00	0.00	100.00
	91	10.14	0.00	28.36	24.80	4.23	32.47	0.00	0.00	0.00	100.00
MEAN		21.67	0.00	20.20	28.37	7.10	22.64	0.00	0.00	0.00	100.00

Per Acre Load Contributed from Each Land Use in Shenandoah Basin for Alternative No. 2 (lb/ac)

Segment 190

	Pervious FOR	HTC	LTC	PAS	URB	HAY	Impervious ANML	RES	Total Load
NH3									
84	0.07395	0.0	4.264	0.122	0.518	1.102	259.1135	1.08	0.672519
85	0.05978	0.0	2.96	0.09196	0.492	0.4351	253.8161	0.969	0.477282
86	0.03314	0.0	0.9344	0.04404	0.126	0.1982	143.745	1.02	0.207013
87	0.05784	0.0	2.666	0.08217	0.387	0.4592	255.5246	1.05	0.450405
88	0.03436	0.0	1.18	0.04569	0.09389	0.1656	160.2792	0.992	0.225919
89	0.06837	0.0	4.064	0.09252	0.33	1.717	256.1574	1.13	0.7086
90	0.06026	0.0	4.596	0.08365	0.371	0.5272	233.8467	1.07	0.591968
91	0.05155	0.0	2.323	0.07117	0.248	0.5449	194.4052	1.02	0.394596
MEAN	0.054906	0.0	2.873425	0.07915	0.320736	0.64365	219.611	1.041375	0.466038
NO3									
84	1.48	0.0	13.55	6.12	7.65	4.779	64.77838	2.38	4.25933
85	1.53	0.0	15.37	5.54	6.76	2.851	63.45402	2.13	3.990734
86	0.862	0.0	8.09	3.07	3.29	1.789	35.93626	2.23	2.201889
87	1.26	0.0	12.64	4.86	6.04	3.552	63.88116	2.32	3.54464
88	0.847	0.0	5.875	3.28	3.49	2.158	40.0698	2.18	2.137103
89	1.37	0.0	19.76	5.78	6.87	4.253	64.03936	2.47	4.468517
90	1.43	0.0	13.32	5.29	6.33	3.311	58.46167	2.35	3.763114
91	1.21	0.0	8.483999	4.26	4.92	2.804	48.6013	2.25	2.906913
MEAN	1.248625	0.0	12.13612	4.775	5.668751	3.187125	54.90275	2.28875	3.40903
ORGN									
84	0.64183	0.0	4.298	1.63611	3.5616	2.125	1554.681	3.39836	2.20245
85	0.44149	0.0	7.635	1.113	3.45401	2.133	1522.896	3.06446	2.20665
86	0.139496	0.0	0.7703	0.42294	0.66038	0.3084	862.4703	3.21286	0.71993
87	0.39326	0.0	4.555	0.94976	2.62297	1.91	1533.148	3.33529	1.845124
88	0.104251	0.0	0.314	0.40439	0.359499	0.0717	961.6753	3.13495	0.65385
89	0.45633	0.0	2.185	0.99799	2.03679	1.076	1536.945	3.55789	1.577851
90	0.368032	0.0	3.468	0.91266	2.44118	1.753	1403.08	3.37239	1.661004
91	0.322399	0.0	2.378	0.8162	1.52852	0.7022	1166.431	3.23883	1.247596
MEAN	0.358386	0.0	3.200413	0.906631	2.083118	1.259912	1317.666	3.289379	1.514307
TN									
84	2.19578	0.0	22.11	7.87811	11.7296	8.007	2267.243	6.85836	7.292219
85	2.03127	0.0	25.97	6.74496	10.70601	5.419	2220.891	6.16346	6.829739
86	1.034636	0.0	9.795	3.53698	4.07638	2.295	1257.769	6.46286	3.216405
87	1.7111	0.0	19.86	5.89193	9.04997	5.921	2235.841	6.70529	5.995832
88	0.985611	0.0	7.369	3.73008	3.943389	2.395	1402.443	6.30695	3.114538
89	1.8947	0.0	26.01	6.87051	9.236791	7.046	2241.378	7.15789	6.911187
90	1.858292	0.0	21.39	6.28631	9.14218	5.591	2046.159	6.79239	6.159048
91	1.583949	0.0	13.19	5.14737	6.69652	4.051	1701.045	6.50883	4.667962
MEAN	1.661917	0.0	18.21175	5.760781	8.072605	5.090625	1921.596	6.619503	5.523366
PO4									
84	0.05055	0.0	1.684	0.0749	0.471	1.364	64.77838	0.481	0.397992
85	0.02645	0.0	1.398	0.05413	0.461	0.6514	63.45402	0.433	0.27308
86	0.00938	0.0	0.6226	0.02004	0.07753	0.3945	35.93626	0.454	0.131482
87	0.02937	0.0	1.454	0.04623	0.346	0.9056	63.88116	0.471	0.300052
88	0.005542	0.0	0.5172	0.01921	0.03386	0.2301	40.0698	0.443	0.100346
89	0.03351	0.0	2.029	0.04997	0.261	1.555	64.03936	0.503	0.417374
90	0.02245	0.0	2.094	0.04503	0.319	0.9055	58.46167	0.477	0.339246
91	0.02436	0.0	1.388	0.03794	0.194	1.085	48.6013	0.458	0.29503
MEAN	0.025202	0.0	1.39835	0.043431	0.270424	0.886387	54.90275	0.465	0.281825
ORGP									
84	0.09169	0.0	1.155	0.23373	0.5088	0.5723	259.1135	0.48548	0.401459
85	0.06307	0.0	2.094	0.159	0.49343	0.5974	253.8161	0.43778	0.438495
86	0.019928	0.0	0.2087	0.06042	0.09434	0.08536	143.745	0.45898	0.123361
87	0.05618	0.0	1.226	0.13568	0.37471	0.5216	255.5246	0.47647	0.350327
88	0.014893	0.0	0.08436	0.05777	0.051357	0.01926	160.2792	0.44785	0.106685
89	0.06519	0.0	0.5951	0.14257	0.29097	0.2984	256.1574	0.50827	0.278316
90	0.052576	0.0	0.9505	0.13038	0.34874	0.4885	233.8467	0.48177	0.312679
91	0.046057	0.0	0.6431	0.1166	0.21836	0.1914	194.4052	0.46269	0.222639
MEAN	0.051198	0.0	0.869595	0.129519	0.297588	0.346778	219.611	0.469911	0.279245

Segment 190

	<-----Pervious-----						<----Impervious---->		
	FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Total Load
TP									
84	0.14224	0.0	2.839	0.30863	0.9798	1.936	453.4486	0.96648	0.852064
85	0.08952	0.0	3.492	0.21313	0.95443	1.249	444.1781	0.87078	0.763172
86	0.029308	0.0	0.8313	0.08046	0.17187	0.4799	251.5538	0.91298	0.284055
87	0.08555	0.0	2.68	0.18191	0.72071	1.427	447.1681	0.94747	0.702275
88	0.020435	0.0	0.6016	0.07698	0.085217	0.2494	280.4886	0.89085	0.239606
89	0.0987	0.0	2.624	0.19254	0.55197	1.853	448.2755	1.01127	0.747683
90	0.075026	0.0	3.045	0.17541	0.66774	1.394	409.2317	0.95877	0.699477
91	0.070417	0.0	2.031	0.15454	0.41236	1.276	340.2091	0.92069	0.557116
MEAN	0.076399	0.0	2.267987	0.17295	0.568012	1.233037	384.3192	0.934911	0.605681
BOD									
84	5.19	0.0	65.10001	13.23	28.8	39.9	4534.486	27.48	19.48365
85	3.57	0.0	142.2	9.0	27.93	40.5	4441.781	24.78	23.32123
86	1.128	0.0	11.46	3.42	5.34	6.210001	2515.538	25.98	4.837374
87	3.18	0.0	79.8	7.68	21.21	36.9	4471.681	26.97	17.41364
88	0.843	0.0	8.820001	3.27	2.907	2.466	2804.886	25.35	3.952744
89	3.69	0.0	46.2	8.070001	16.47	21.99	4482.755	28.77	13.21006
90	2.976	0.0	68.10001	7.380001	19.74	33.6	4092.317	27.27	15.74198
91	2.607	0.0	38.7	6.6	12.36	13.95	3402.091	26.19	10.05395
MEAN	2.898	0.0	57.5475	7.33125	16.84463	24.4395	3843.192	26.59875	13.50183
SED									
84	0.161	0.0	1.01	0.377	0.291	0.764	0.0	0.0	0.34842
85	0.07501	0.0	1.72	0.247	0.285	0.751	0.0	0.0	0.327416
86	0.03091	0.0	0.175	0.0886	0.04231	0.111	0.0	0.0	0.06382
87	0.07149	0.0	1.05	0.208	0.211	0.682	0.0	0.0	0.254502
88	0.01559	0.0	0.07836	0.08145	0.01251	0.03172	0.0	0.0	0.035972
89	0.08934	0.0	0.517	0.213	0.149	0.391	0.0	0.0	0.186156
90	0.06207	0.0	0.806	0.197	0.191	0.619	0.0	0.0	0.220583
91	0.06088	0.0	0.553	0.18	0.115	0.255	0.0	0.0	0.14878
MEAN	0.070786	0.0	0.73867	0.199006	0.162103	0.45059	0.0	0.0	0.198206

Segment 200

	Pervious						Impervious		Total
	FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Load
NH3									
84	0.05779	0.0	3.641	0.118	0.57	0.8702	228.8566	1.38	0.507949
85	0.04321	0.0	2.074	0.06504	0.206	0.1965	203.4	1.28	0.287559
86	0.02965	0.0	0.807	0.0435	0.13	0.2659	127.8527	1.32	0.173152
87	0.03721	0.0	1.997	0.06537	0.211	0.2662	212.675	1.37	0.291421
88	0.02937	0.0	1.355	0.0371	0.121	0.1473	141.7562	1.26	0.197445
89	0.03945	0.0	3.425	0.06877	0.232	0.5904	194.6222	1.45	0.415426
90	0.04685	0.0	4.179	0.08391	0.293	0.3143	222.158	1.41	0.454028
91	0.03502	0.0	1.454	0.04402	0.119	0.3283	135.7537	1.33	0.226321
MEAN	0.039819	0.0	2.3665	0.065714	0.23525	0.372387	183.3843	1.35	0.319163
NO3									
84	1.3	0.0	10.23	5.81	7.45	4.469	57.21416	2.54	3.635224
85	1.19	0.0	10.53	4.55	4.81	1.918	50.85	2.35	2.886417
86	0.78	0.0	6.144	2.99	3.22	1.614	31.96318	2.41	1.898076
87	0.874	0.0	12.1	3.8	4.3	2.56	53.16876	2.5	2.686324
88	0.688	0.0	5.205	2.83	3.2	1.839	35.43906	2.3	1.773496
89	0.838	0.0	13.17	3.96	4.65	3.103	48.65554	2.65	2.850053
90	1.15	0.0	12.86	4.81	5.47	2.85	55.5395	2.58	3.213923
91	0.943	0.0	4.01	3.31	3.48	2.113	33.93842	2.44	1.989804
MEAN	0.970375	0.0	9.281125	4.0075	4.5725	2.55825	45.84608	2.47125	2.616664
ORGN									
84	0.52311	0.0	4.221	1.60272	4.0439	2.015	1373.14	3.31674	1.846655
85	0.228165	0.0	1.243	0.65296	1.19091	0.5972	1220.4	3.07188	0.922453
86	0.111671	0.0	0.4838	0.41923	0.7049	0.1666	767.1164	3.16092	0.539613
87	0.188097	0.0	1.282	0.76055	1.2985	0.4434	1276.05	3.27593	0.940022
88	0.116865	0.0	0.717	0.280476	0.64183	0.1916	850.5375	3.01252	0.5488
89	0.267862	0.0	1.567	0.80507	1.45061	0.5323	1167.733	3.47256	0.995713
90	0.335384	0.0	2.981	1.01654	1.87355	1.598	1332.948	3.37239	1.358608
91	0.089782	0.0	1.224	0.365806	0.58247	0.552	814.5221	3.1906	0.612749
MEAN	0.232617	0.0	1.71485	0.737919	1.473334	0.762013	1100.306	3.234192	0.970577
TN									
84	1.8809	0.0	18.09	7.53072	12.0639	7.354001	2002.496	7.23674	6.101658
85	1.461375	0.0	13.84	5.268	6.20691	2.712	1779.75	6.70188	4.195534
86	0.921321	0.0	7.435	3.45273	4.0549	2.046	1118.711	6.89092	2.67336
87	1.099307	0.0	15.38	4.62592	5.8095	3.27	1860.907	7.14593	4.021934
88	0.834235	0.0	7.278	3.147576	3.96283	2.177	1240.367	6.57252	2.589072
89	1.145312	0.0	18.16	4.83384	6.33261	4.226	1702.944	7.572559	4.356323
90	1.532234	0.0	20.02	5.91045	7.63655	4.762	1943.882	7.36239	5.135229
91	1.067802	0.0	6.688	3.719826	4.18147	2.994	1187.845	6.9606	2.895371
MEAN	1.242811	0.0	13.36138	4.811133	6.281084	3.692625	1604.613	7.055442	3.996061
PO4									
84	0.01275	0.0	1.325	0.07378	0.545	0.9965	57.21416	0.472	0.267913
85	0.004142	0.0	1.004	0.03355	0.15	0.2749	50.85	0.437	0.134192
86	0.002498	0.0	0.4204	0.01954	0.08389	0.4709	31.96318	0.449	0.103587
87	0.003925	0.0	0.9833	0.0365	0.167	0.5648	53.16876	0.466	0.165889
88	0.002625	0.0	0.5384	0.01425	0.07615	0.2251	35.43906	0.428	0.08465
89	0.006005	0.0	1.233	0.03844	0.187	0.7986	48.65554	0.494	0.207956
90	0.007046	0.0	1.692	0.04843	0.244	0.7256	55.5395	0.479	0.237737
91	0.001943	0.0	0.9597	0.01823	0.06614	0.7701	33.93842	0.454	0.168732
MEAN	0.005117	0.0	1.019475	0.03534	0.189898	0.603312	45.84608	0.459875	0.171332
ORGP									
84	0.07473	0.0	1.138	0.22896	0.5777	0.5457	228.8566	0.47382	0.335834
85	0.032595	0.0	0.3389	0.09328	0.17013	0.1651	203.4	0.43884	0.159974
86	0.015953	0.0	0.1305	0.05989	0.1007	0.04549	127.8527	0.45156	0.089259
87	0.026871	0.0	0.3446	0.10865	0.1855	0.1197	212.675	0.46799	0.16047
88	0.016695	0.0	0.1928	0.040068	0.09169	0.05157	141.7562	0.43036	0.093343
89	0.038266	0.0	0.4249	0.11501	0.20723	0.1458	194.6222	0.49608	0.17153
90	0.047912	0.0	0.8094	0.14522	0.26765	0.4421	222.158	0.48177	0.251464
91	0.012826	0.0	0.3281	0.052258	0.08321	0.1477	135.7537	0.4558	0.110913
MEAN	0.033231	0.0	0.4634	0.105417	0.210476	0.207895	183.3843	0.462027	0.171598

Segment 200

	<-----------	------------	Pervious	-----------	------------	--------->	<----Impervious	---->	Total
	FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Load
TP									
84	0.08748	0.0	2.463	0.30274	1.1227	1.542	400.4991	0.94582	0.641052
85	0.036737	0.0	1.343	0.12683	0.32013	0.44	355.95	0.87584	0.327347
86	0.018451	0.0	0.551	0.07943	0.18459	0.5164	223.7423	0.90056	0.213706
87	0.030796	0.0	1.328	0.14515	0.3525	0.6845	372.1813	0.93399	0.361053
88	0.01932	0.0	0.7312	0.054318	0.16784	0.2766	248.0734	0.85836	0.201106
89	0.044271	0.0	1.658	0.15345	0.39423	0.9445	340.5888	0.99008	0.411246
90	0.054958	0.0	2.501	0.19365	0.51165	1.168	388.7765	0.96077	0.52544
91	0.014769	0.0	1.288	0.070488	0.14935	0.9179	237.5689	0.9098	0.30181
MEAN	0.038348	0.0	1.4829	0.140757	0.400374	0.811237	320.9225	0.921903	0.372845
BOD									
84	4.23	0.0	59.1	12.96	32.7	51.9	4004.991	26.82	17.95011
85	1.845	0.0	22.77	5.28	9.63	18.84	3559.5	24.84	7.685593
86	0.903	0.0	7.68	3.39	5.7	3.99	2237.423	25.56	3.588633
87	1.521	0.0	19.95	6.15	10.5	12.12	3721.813	26.49	6.958815
88	0.945	0.0	13.47	2.268	5.19	6.57	2480.734	24.36	4.022025
89	2.166	0.0	28.23	6.510001	11.73	18.12	3405.888	28.08	8.528705
90	2.712	0.0	50.1	8.22	15.15	50.7	3887.765	27.27	14.36487
91	0.726	0.0	14.73	2.958	4.71	11.31	2375.689	25.8	4.608787
MEAN	1.881	0.0	27.00375	5.967	11.91375	21.69375	3209.225	26.1525	8.463443
SED									
84	0.15	0.0	0.99	0.351	0.524	0.722	0.0	0.0	0.329046
85	0.03882	0.0	0.292	0.129	0.125	0.219	0.0	0.0	0.099306
86	0.02627	0.0	0.114	0.0828	0.07266	0.06218	0.0	0.0	0.051127
87	0.03697	0.0	0.302	0.159	0.147	0.166	0.0	0.0	0.101694
88	0.02868	0.0	0.171	0.04936	0.06394	0.07286	0.0	0.0	0.048788
89	0.0604	0.0	0.371	0.168	0.167	0.198	0.0	0.0	0.125002
90	0.06652	0.0	0.686	0.215	0.221	0.566	0.0	0.0	0.200992
91	0.01242	0.0	0.285	0.06751	0.05166	0.2	0.0	0.0	0.064519
MEAN	0.05251	0.0	0.401375	0.152709	0.171532	0.275755	0.0	0.0	0.127559

Percent of Total Load Contributed from Each Land Use in Shenandoah Basin for Alternative No. 2

Segment 190

		Pervious						Impervious			
		FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Point Source	Total Load
NH3											
	84	1.87	0.00	15.98	1.36	1.89	6.74	5.38	1.16	65.60	100.00
	85	1.87	0.00	13.72	1.27	2.22	3.29	6.53	1.28	69.84	100.00
	86	1.24	0.00	5.15	0.72	0.68	1.78	4.40	1.61	84.46	100.00
	87	1.70	0.00	11.56	1.06	1.64	3.25	6.15	1.30	73.33	100.00
	88	1.14	0.00	5.77	0.67	0.45	1.32	4.34	1.38	84.94	100.00
	89	2.02	0.00	17.76	1.21	1.41	12.24	6.20	1.41	57.77	100.00
	90	1.91	0.00	21.58	1.17	1.70	4.04	6.09	1.44	62.09	100.00
	91	1.96	0.00	13.05	1.19	1.36	4.99	6.05	1.64	69.73	100.00
MEAN		1.73	0.00	13.37	1.10	1.45	4.89	5.67	1.38	70.40	100.00
NO3											
	84	16.83	0.00	22.79	30.71	12.54	13.11	0.60	1.14	2.29	100.00
	85	18.59	0.00	27.61	29.70	11.84	8.36	0.63	1.09	2.18	100.00
	86	18.75	0.00	26.03	29.48	10.32	9.39	0.64	2.05	3.33	100.00
	87	17.16	0.00	25.46	29.21	11.86	11.67	0.71	1.34	2.57	100.00
	88	18.95	0.00	19.43	32.39	11.25	11.65	0.74	2.06	3.54	100.00
	89	14.93	0.00	31.83	27.80	10.79	11.18	0.57	1.14	1.75	100.00
	90	18.44	0.00	25.40	30.12	11.77	10.30	0.62	1.28	2.07	100.00
	91	20.09	0.00	20.83	31.22	11.78	11.23	0.66	1.58	2.61	100.00
MEAN		17.71	0.00	25.46	29.90	11.59	10.91	0.64	1.37	2.41	100.00
ORGN											
	84	13.55	0.00	13.42	15.25	10.84	10.82	26.91	3.03	6.18	100.00
	85	9.37	0.00	23.95	10.42	10.56	10.92	26.49	2.75	5.52	100.00
	86	8.33	0.00	6.80	11.14	5.68	4.44	42.22	8.11	13.28	100.00
	87	9.84	0.00	16.85	10.49	9.46	11.53	31.46	3.53	6.87	100.00
	88	6.52	0.00	2.90	11.15	3.24	1.08	49.28	8.28	17.55	100.00
	89	13.16	0.00	9.31	12.70	8.46	7.48	36.33	4.33	8.21	100.00
	90	10.12	0.00	14.10	11.08	9.68	11.63	31.64	3.92	7.83	100.00
	91	11.53	0.00	12.57	12.88	7.88	6.06	34.20	4.89	10.00	100.00
MEAN		10.77	0.00	14.22	12.02	9.02	9.13	32.46	4.18	8.19	100.00
TN											
	84	12.33	0.00	18.38	19.54	9.50	10.86	10.45	1.63	17.33	100.00
	85	12.35	0.00	23.35	18.09	9.38	7.95	11.07	1.58	16.22	100.00
	86	11.33	0.00	15.86	17.10	6.44	6.06	11.29	2.99	28.92	100.00
	87	11.36	0.00	19.50	17.26	8.66	9.49	12.17	1.88	19.68	100.00
	88	10.61	0.00	11.72	17.71	6.11	6.22	12.37	2.87	32.38	100.00
	89	11.59	0.00	23.53	18.55	8.15	10.40	11.24	1.85	14.69	100.00
	90	12.53	0.00	21.33	18.72	8.89	9.10	11.31	1.94	16.19	100.00
	91	13.55	0.00	16.67	19.42	8.26	8.36	11.93	2.35	19.44	100.00
MEAN		12.02	0.00	19.48	18.39	8.42	8.88	11.40	2.02	19.39	100.00
PO4											
	84	3.37	0.00	16.59	2.20	4.52	21.92	3.54	1.35	46.52	100.00
	85	2.22	0.00	17.35	2.01	5.58	13.19	4.37	1.54	53.75	100.00
	86	1.11	0.00	10.90	1.05	1.32	11.27	3.49	2.27	68.57	100.00
	87	2.29	0.00	16.78	1.59	3.89	17.06	4.09	1.55	52.75	100.00
	88	0.72	0.00	9.92	1.10	0.63	7.20	4.26	2.43	73.75	100.00
	89	2.78	0.00	24.85	1.83	3.12	31.08	4.35	1.76	30.21	100.00
	90	2.14	0.00	29.52	1.89	4.38	20.83	4.57	1.92	34.75	100.00
	91	2.48	0.00	20.90	1.70	2.85	26.65	4.06	1.97	39.38	100.00
MEAN		2.28	0.00	18.74	1.74	3.53	19.38	4.08	1.78	48.46	100.00
ORGP											
	84	9.82	0.00	18.30	11.05	7.86	14.79	22.77	2.20	13.21	100.00
	85	6.32	0.00	31.04	7.03	7.13	14.44	20.87	1.85	11.33	100.00
	86	5.67	0.00	8.79	7.59	3.87	5.86	33.57	5.52	29.11	100.00
	87	6.80	0.00	21.94	7.25	6.54	15.23	25.37	2.44	14.44	100.00
	88	4.35	0.00	3.65	7.45	2.16	1.36	38.43	5.53	37.07	100.00
	89	10.23	0.00	13.81	9.88	6.58	11.30	32.96	3.37	11.86	100.00
	90	7.44	0.00	19.90	8.15	7.12	16.68	27.14	2.88	10.70	100.00
	91	8.71	0.00	17.99	9.73	5.95	8.74	30.15	3.70	15.00	100.00
MEAN		7.70	0.00	19.33	8.59	6.45	12.58	27.07	2.99	15.31	100.00

Segment 190

		FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Point Source	Total Load
		<------	------	------	Pervious	------	------>	<----Impervious	-->		
TP											
	84	5.60	0.00	16.51	5.36	5.56	18.38	14.63	1.61	32.33	100.00
	85	3.90	0.00	22.52	4.10	6.00	13.14	15.89	1.60	32.86	100.00
	86	2.34	0.00	9.80	2.83	1.97	9.23	16.44	3.08	54.32	100.00
	87	3.87	0.00	17.91	3.63	4.70	15.56	16.58	1.81	35.93	100.00
	88	1.73	0.00	7.55	2.88	1.04	5.10	19.51	3.19	58.99	100.00
	89	5.06	0.00	19.90	4.36	4.08	22.93	18.85	2.19	22.58	100.00
	90	4.05	0.00	24.32	4.18	5.20	18.17	18.12	2.19	23.77	100.00
	91	4.43	0.00	18.89	4.29	3.74	19.36	17.54	2.45	29.31	100.00
MEAN		4.11	0.00	18.04	4.11	4.40	16.00	16.95	2.12	34.25	100.00
BOD											
	84	12.28	0.00	22.78	13.82	9.82	22.78	8.80	2.75	6.98	100.00
	85	7.23	0.00	42.62	8.05	8.16	19.80	7.38	2.12	4.64	100.00
	86	9.28	0.00	13.94	12.42	6.33	12.33	16.97	9.03	19.70	100.00
	87	8.32	0.00	30.88	8.87	8.00	23.30	9.60	2.98	8.05	100.00
	88	7.61	0.00	11.78	13.03	3.78	5.37	20.77	9.67	27.97	100.00
	89	12.41	0.00	22.97	11.98	7.98	17.84	12.36	4.09	10.38	100.00
	90	8.54	0.00	28.90	9.35	8.17	23.26	9.63	3.31	8.86	100.00
	91	11.16	0.00	24.48	12.47	7.62	14.40	11.93	4.74	13.21	100.00
MEAN		9.62	0.00	28.24	10.74	8.06	19.57	10.46	3.73	9.57	100.00
SED											
	84	22.90	0.00	21.24	23.66	5.97	26.22	0.00	0.00	0.00	100.00
	85	11.35	0.00	38.50	16.50	6.22	27.43	0.00	0.00	0.00	100.00
	86	24.00	0.00	20.10	30.37	4.74	20.80	0.00	0.00	0.00	100.00
	87	13.92	0.00	30.23	17.88	5.92	32.04	0.00	0.00	0.00	100.00
	88	21.48	0.00	15.96	49.53	2.48	10.54	0.00	0.00	0.00	100.00
	89	23.78	0.00	20.35	25.02	5.72	25.11	0.00	0.00	0.00	100.00
	90	13.95	0.00	26.78	19.54	6.19	33.56	0.00	0.00	0.00	100.00
	91	20.29	0.00	27.25	26.47	5.52	20.50	0.00	0.00	0.00	100.00
MEAN		17.70	0.00	27.32	21.97	5.85	27.19	0.00	0.00	0.00	100.00

Segment 200

		FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Point Source	Total Load
		<----	----	----	Pervious	----	----><	----Impervious	-->		
NH3											
	84	1.94	0.00	14.94	1.79	1.92	5.82	4.77	1.27	67.56	100.00
	85	1.66	0.00	9.73	1.13	0.80	1.50	4.85	1.35	78.97	100.00
	86	1.30	0.00	4.31	0.86	0.57	2.31	3.47	1.58	85.58	100.00
	87	1.47	0.00	9.62	1.16	0.84	2.09	5.21	1.48	78.12	100.00
	88	1.20	0.00	6.75	0.68	0.50	1.20	3.59	1.41	84.69	100.00
	89	2.13	0.00	22.56	1.67	1.26	6.34	6.51	2.14	57.39	100.00
	90	2.43	0.00	26.47	1.96	1.53	3.25	7.15	2.00	55.21	100.00
	91	2.25	0.00	11.42	1.28	0.77	4.21	5.42	2.34	72.32	100.00
MEAN		1.75	0.00	12.71	1.30	1.04	3.26	5.00	1.62	73.32	100.00
NO3											
	84	18.67	0.00	17.92	37.57	10.74	12.77	0.51	1.00	0.86	100.00
	85	21.46	0.00	23.16	36.94	8.71	6.88	0.57	1.16	1.10	100.00
	86	21.31	0.00	20.47	36.77	8.83	8.78	0.54	1.80	1.50	100.00
	87	16.94	0.00	28.59	33.15	8.36	9.87	0.64	1.32	1.14	100.00
	88	20.11	0.00	18.55	37.22	9.39	10.69	0.64	1.84	1.55	100.00
	89	15.34	0.00	29.39	32.63	8.54	11.30	0.55	1.33	0.94	100.00
	90	18.68	0.00	25.48	35.16	8.92	9.21	0.56	1.15	0.83	100.00
	91	24.63	0.00	12.78	38.92	9.12	10.98	0.55	1.74	1.28	100.00
MEAN		19.31	0.00	22.53	35.90	9.13	10.13	0.57	1.34	1.09	100.00
ORGN											
	84	14.66	0.00	14.42	20.21	11.37	11.24	23.84	2.54	1.72	100.00
	85	12.57	0.00	8.35	16.19	6.58	6.55	41.66	4.62	3.48	100.00
	86	10.35	0.00	5.47	17.49	6.56	3.07	44.04	8.00	5.02	100.00
	87	10.19	0.00	8.47	18.55	7.06	4.78	42.84	4.85	3.24	100.00
	88	10.60	0.00	7.93	11.45	5.84	3.46	47.81	7.47	5.45	100.00
	89	13.74	0.00	9.81	18.60	7.47	5.44	37.14	4.87	2.93	100.00
	90	12.72	0.00	13.78	17.35	7.13	12.06	31.31	3.49	2.17	100.00
	91	7.38	0.00	12.26	13.53	4.80	9.02	41.46	7.16	4.38	100.00
MEAN		12.23	0.00	11.00	17.46	7.78	7.97	35.85	4.65	3.06	100.00
TN											
	84	13.71	0.00	16.08	24.71	8.82	10.67	9.04	1.44	15.53	100.00
	85	14.40	0.00	16.64	23.38	6.14	5.32	10.87	1.80	21.46	100.00
	86	12.90	0.00	12.69	21.76	5.70	5.70	9.71	2.64	28.91	100.00
	87	11.29	0.00	19.27	21.39	5.99	6.68	11.84	2.01	21.53	100.00
	88	11.75	0.00	12.50	19.95	5.60	6.10	10.82	2.53	30.77	100.00
	89	12.12	0.00	23.45	23.02	6.73	8.90	11.17	2.19	12.40	100.00
	90	14.02	0.00	22.35	24.35	7.01	8.67	11.02	1.84	10.72	100.00
	91	15.88	0.00	12.13	24.90	6.24	8.86	10.95	2.83	18.23	100.00
MEAN		13.27	0.00	17.39	23.13	6.73	7.84	10.61	2.06	18.98	100.00
PO4											
	84	1.71	0.00	21.68	4.45	7.34	26.60	4.76	1.73	31.74	100.00
	85	0.84	0.00	24.77	3.06	3.05	11.07	6.38	2.42	48.43	100.00
	86	0.60	0.00	12.23	2.10	2.01	22.36	4.73	2.93	53.06	100.00
	87	0.71	0.00	21.59	2.96	3.02	20.23	5.93	2.29	43.28	100.00
	88	0.65	0.00	16.14	1.58	1.88	11.01	5.40	2.87	60.51	100.00
	89	1.04	0.00	25.99	2.99	3.24	27.46	5.21	2.33	31.74	100.00
	90	1.11	0.00	32.48	3.43	3.85	22.73	5.42	2.06	28.91	100.00
	91	0.37	0.00	22.30	1.56	1.26	29.19	4.01	2.36	38.93	100.00
MEAN		0.94	0.00	22.82	2.92	3.50	22.03	5.21	2.31	40.30	100.00
ORGP											
	84	11.00	0.00	20.42	15.16	8.53	15.98	20.86	1.90	6.14	100.00
	85	9.42	0.00	11.94	12.13	4.93	9.49	36.41	3.46	12.21	100.00
	86	7.64	0.00	7.62	12.92	4.84	4.34	37.94	5.91	18.80	100.00
	87	7.73	0.00	12.10	14.08	5.36	6.85	37.94	3.68	12.22	100.00
	88	7.39	0.00	10.41	7.99	4.08	4.55	38.90	5.21	21.44	100.00
	89	10.62	0.00	14.39	14.38	5.78	8.06	33.49	3.76	9.51	100.00
	90	9.36	0.00	19.29	12.77	5.25	17.19	26.89	2.57	6.69	100.00
	91	5.16	0.00	16.11	9.47	3.36	11.83	33.85	5.01	15.19	100.00
MEAN		9.08	0.00	15.44	12.96	5.77	11.30	31.04	3.45	10.94	100.00

Segment 200

		FOR	HTC	LTC	PAS	URB	HAY	ANML	RES	Point Source	Total Load
		<-------------------------			Pervious		---------------->	<----Impervious-->			
TP											
	84	5.85	0.00	20.09	9.11	7.53	20.51	16.58	1.73	18.61	100.00
	85	4.07	0.00	18.13	6.32	3.56	9.69	24.40	2.65	31.16	100.00
	86	2.76	0.00	10.07	5.36	2.78	15.39	20.77	3.69	39.19	100.00
	87	3.18	0.00	16.72	6.74	3.65	14.06	23.81	2.64	29.20	100.00
	88	2.86	0.00	13.18	3.61	2.49	8.14	22.72	3.47	43.54	100.00
	89	4.43	0.00	20.24	6.91	3.96	18.81	21.12	2.71	21.81	100.00
	90	4.52	0.00	25.07	7.17	4.22	19.11	19.80	2.16	17.92	100.00
	91	1.81	0.00	19.26	3.89	1.84	22.40	18.05	3.05	29.69	100.00
MEAN		3.96	0.00	18.69	6.55	4.15	16.68	20.55	2.60	26.81	100.00
BOD											
	84	11.74	0.00	20.01	16.19	9.11	28.66	6.88	2.03	5.38	100.00
	85	11.60	0.00	17.46	14.94	6.08	23.58	13.86	4.27	8.21	100.00
	86	10.69	0.00	11.09	18.07	6.77	9.40	16.41	8.27	19.29	100.00
	87	9.75	0.00	15.61	17.76	6.76	15.47	14.79	4.64	15.25	100.00
	88	9.42	0.00	16.38	10.18	5.19	13.03	15.32	6.64	23.84	100.00
	89	11.66	0.00	18.53	15.77	6.33	19.40	11.35	4.13	12.83	100.00
	90	9.14	0.00	20.59	12.47	5.13	34.01	8.12	2.51	8.04	100.00
	91	6.52	0.00	16.13	11.95	4.24	20.21	13.21	6.33	21.41	100.00
MEAN		10.35	0.00	18.12	14.78	6.58	23.75	10.94	3.93	11.55	100.00
SED											
	84	24.00	0.00	19.32	25.28	8.42	22.99	0.00	0.00	0.00	100.00
	85	20.59	0.00	18.88	30.79	6.65	23.11	0.00	0.00	0.00	100.00
	86	27.05	0.00	14.32	38.39	7.51	12.74	0.00	0.00	0.00	100.00
	87	19.14	0.00	19.07	37.05	7.64	17.10	0.00	0.00	0.00	100.00
	88	30.96	0.00	22.51	23.98	6.93	15.65	0.00	0.00	0.00	100.00
	89	25.44	0.00	19.05	31.85	7.06	16.60	0.00	0.00	0.00	100.00
	90	17.43	0.00	21.92	25.35	5.81	29.51	0.00	0.00	0.00	100.00
	91	10.14	0.00	28.36	24.80	4.23	32.47	0.00	0.00	0.00	100.00
MEAN		21.67	0.00	20.20	28.37	7.10	22.64	0.00	0.00	0.00	100.00

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13. ABSTRACT ***(Maximum 200 words)***

The focus of this research work was to improve the overall utility of the Chesapeake Bay Watershed Model, based on the U.S. Environmental Protection Agency Hydrologic Simulation Program-Fortran (HSPF) model, as a planning tool for comprehensive watershed planning and assessment. The specific improvements recommended and tasks performed in this effort included refinement of the agricultural (AGCHEM) module simulation to better represent plant uptake impacts of agricultural practices and nutrient management scenarios, testing the AGCHEM refinements, applying the refined AGCHEM to selected subbasins of the Chesapeake Bay drainage, and recalibrating the refined Watershed Model to the selected subbasins.

The addition of a yield-based plant uptake option in the AGCHEM module of HSPF, derived from the Nitrate Leaching and Economic Analysis Package uptake formulation, provides an improved algorithm for representing the plant uptake component of nutrient balances for agricultural croplands. The new algorithm allows for direct consideration of expected plant yield levels for both N and P, seasonal distribution of uptake rates and multiple cropping periods, N fixation by leguminous plants, and stress conditions related to available nutrient levels and moisture conditions.

(Continued)

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Testing of the algorithm shows that it is sensitive to the available plant nutrients in the soil layers and to the target levels defined by the user corresponding to expected crop yields. Furthermore, decreased application rates will allow uptake levels to remain unchanged only if the plant-available nutrients are sufficient to meet crop needs. This has important implications for agricultural Best Management Practices that include nutrient reduction components.

The overall Watershed Model recalibration results show a significant improvement from earlier efforts with improved seasonal variation and tracking of the observed nutrient concentration values. However, problems still remain for selected constituents and subbasin sites, and further "fine tuning" of the calibration is recommended along with more detailed investigations into the instream algal and benthic simulation.

Demonstration simulations of alternative nutrient reduction scenarios have shown that the Watershed Model with the refined AGCHEM plant uptake routines provides a reasonable representation of nutrient balances at the watershed scale for evaluation of management options for nutrient reduction objectives.